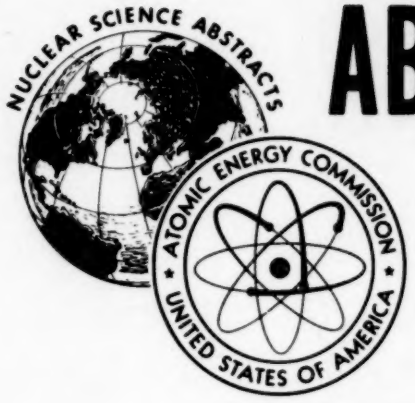
NUCLEAR SCIENCE ABSTRACTS



Volume 30 Number 4

Abstracts 9027-12201

August 31, 1974

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Volume 30, Number 4, August 31, 1974

NUCLEAR SCIENCE ABSTRACTS

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Published by the USAEC Technical Information Center

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Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

SMITH, H., Planetary nebulae: two types, 29:13374
SMITH, H.R. Jr., Principles of electron beam technology, 29:13155
SMITH, J., See HOEGERMAN, S.F., 29:13035
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REACTOR PROTECTION SYSTEMS
HTGR gas turbine power plant control and safety studies. Quarterly progress report for the period July 1, 1973--September 30, 1973, 29:14846 (GULF-GA-A-12799)

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is indexed as:

USAEC DIVISION OF CONTROLLED THERMONUCLEAR RESEARCH, WASHINGTON, D.C.
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Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USAEC Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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Volume 30, Number 4 August 31, 1974

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

9027 ANALIZ TSVETNYKH METALLOV I SPLAVOV. (Analysis of Non-Ferrous Metals and Alloys). Stepin, V. V.; Silaeva, E. V.; Kurbatova, V. I.; Fedorova, N. D.; Ponosov, V. I. Moscow; Metallurgiya (1974). 208p.

Methods for the analysis of non-ferrous metals and alloys used in the certification of standard samples containing C, S, Cu, Be, Mg, Ca, Zn, Pb, Bi, Sn, P, As, Sb, Zr, Mn, Fe, Co, Ni, Na, Cd, Ti, Si, and Al are described. The methods described are suitable for laboratories certifying products from the metallurgical industry. (tr-auth)

9028 ANALYSIS OF RADIOACTIVE PRODUCTS. Baudin, G.; Regnaud, F. (CEN, Fontenay-aux-Roses, France). Bull. Inform. Sci. Tech. (Paris); No. 188, 43-51(Jan 1974). (In French).

The equipment of the Analytical Research Service used for analyzing radioactive materials is described. Most of the chemical analysis is conducted using a series of hot cells and glove boxes. Some applications are presented: analysis of fissile materials; determination of neutron data and specific burn-ups; chemical analysis of transuranic elements; fission and corrosion product determinations; studies of the nitriding and carbon losses from steels; analysis of insoluble residues from fuel reprocessing. (FR)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 9622, 10077, and 10136.

9029 (CNAEM-R-111) SOME ASPECTS IN THE DETERMINATION OF TOTAL BODY SODIUM. Birol, E. (Cekmece Nuclear Research Center, Istanbul (Turkey)). 1973. 47p. Dep. NTIS (US Sales Only) $5.50.

Thesis.

The contribution of the ^{42}K(1.52 MeV) peak to the ^{24}Na(1.37 MeV) peak and to the ^{38}Cl(1.6 MeV) peak following whole-body irradiation in neutron activation analysis "in vivo" was determined. A phantom filled with tissue equivalent solution was irradiated under the identical conditions used for the diagnostic purposes. The relative contribution of ^{42}K(1.52 MeV) peak to the ^{24}Na(1.37 MeV) peak and for the ^{38}Cl(1.6 MeV) peak at FWHM region were found to be 2.9% and 6.4% of the ^{40}K counts under the photopeak respectively. The interference from ^{42}K(1.52 MeV) peak was calculated as 1% for the ^{24}Na(1.37 MeV) peak and 4.6% for the ^{38}Cl(1.6 MeV) peak at their FWHM region. (auth)

9030 (EURISOTOP-90) DETERMINATION OF NITROGEN IN REFRACTORY METALS. Its Technological and Economic Importance. Albert, P. (Commission of the European Communities, Brussels (Belgium). Bureau Eurisotop). May 1974. 72p. (In French). Dep. NTIS (US Sales Only) $6.75.

On the basis of inquiries made of the principal manufacturers and fabricators of Nb, Ta, Mo, W, V, Ti, and Zr, an attempt was made to define the technological importance and economic aspects of the determination of N in these refractory metals. The classical chemical and extraction methods are summarized. Laboratory methods developed in recent years include fusion under vacuum or carrier gas, spectrometry, activation analysis, and nuclear reaction analysis. These methods are compared. (JSR)

9031 (IFA-CRD-55-1973) CHARGED PARTICLE INDUCED X-RAYS AND NUCLEAR REACTIONS AND THEIR USE IN MICRO-ANALYSIS. Lukas, I. R. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 91p. Dep. NTIS (US Sales Only) $7.50.

Analysis based on the emission of x-rays by charged particle bombardment of the sample and elastic and inelastic scattering of charged particles by nuclei is reviewed. (LK)

9032 (IRI-133-73-17) CATALOGUE OF GAMMA-RAY AND ISOTOPE DATA FOR USE IN NEUTRON ACTIVATION ANALYSIS. de Bruin, M.; Korthoven, P. J. M.; Faasse-van Peer, M. J. J. A. (Interuniversitair Reactor Instituut, Delft (Netherlands)). [nd]. 34p. Dep. NTIS (US Sales Only) $4.75.

This catalogue contains experimental energy and relative intensity data of gamma rays emitted by isotopes relevant in thermal neutron activation analysis. A limited number of ^{235}U fission products, which could interfere with the determination of other elements, is also included in the catalogue. In addition, specific gamma yields are given as photon emission rates per unit mass after irradiation for unit time. The catalogue is available in two versions. Version I contains the data with the isotopes listed in order of increasing atomic number. Version II also contains the data listed in order of increasing energy of emitted gamma radiation. Version I can be obtained free of charge. For version II a payment of $5 will be required to cover printing costs. (auth)

9033 (N-73-30988) ANALYTICAL AND RADIO-HISTOCHEMICAL EXPERIMENTS OF PLANTS AND TISSUE CULTURE CELLS TREATED WITH LUNAR AND TERRESTRIAL MATERIALS. Final Report. Halliwell, R. S. (Texas Agricultural Experiment Station, College Station (USA)). 1973. Contract NAS9-12050. 127p. (NASA-CR-134036; BB-321-55-407-P). NTIS $8.50.

The nature and mechanisms of the apparent stimulation of growth originally observed in plants growing in contact with lunar soil during the Apollo project quarantine are examined. Preliminary experiments employing neutron activated lunar soil indicate uptake of a few elements by plants. It was found that while the preliminary neutron activation technique allowed demonstration of uptake of minerals it presented numerous disadvantages for use in critical experiments directed at elucidating possible mechanisms of stimulation. (auth)

9034 (ORNL-TM-4601) CRYSTAL BALL: A COMPUTER PROGRAM FOR DETERMINING NEUTRON SPECTRA FROM ACTIVATION MEASUREMENTS. Kam, F. B. K.; Stallmann, F. W. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 38p. Dep. NTIS $5.00.

Computer program CRYSTAL BALL uses a new method for the determination of neutron spectrum activation measurements. The method is based on direct approximation of Dirac's delta operator by linear combination of integral operators. Test cases using experimental data have demonstrated that the method is highly stable unless unrealistically low convergence criteria are imposed. Numerical games indicated that the solution is relatively insensitive to the choice of the initial guessed spectrum except where the energy ranges are poorly covered by the cross sections. The user will find the code easy to apply and easy to modify to suit his needs. (auth)

9035 (ORO-4254-17) DETERMINATION OF FREE CHLORINE IN NATURAL WATERS. Whitfield, P. (Oklahoma State Univ., Stillwater (USA)). Mar 1974. 12p. Dep. NTIS $4.00.

Three colorimetric procedures for the determination of free chlorine in H_2O are reviewed. The syringaldazine method, in

which syringaldazine is oxidized by hypochlorous acid, appears to be the best method for measuring low levels of free chlorine in natural water systems. Proton or neutron activation provides extremely low detection limits for total chlorine when this sensitivity is required. (JGB)

9036 (SGAE-2254) PROMPT NEUTRON ACTIVATION ANALYSIS (NAA) AND ITS USE IN THE DETERMINATION OF BORON AND CADMIUM IN AQUEOUS SOLUTIONS AND IN HUMAN URINE. Yaghubian, R.; Lanzel, E. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.). Mar 1974. 19p. (In German). (CONF-740120-2). Dep. NTIS $4.00.

From 11th international symposium on radioactive isotopes in clinical medicine and research; Bad Gastein, Austria (8 Jan 1974).

The method of prompt neutron activation analysis is reviewed. Sample preparation and determination of boron and cadmium in urine and aqueous solutions are discussed. (LK)

9037 RARE EARTH ELEMENT COMPOSITION OF ATMOSPHERIC PARTICULATES. Potts, M. J.; Lee, C. W.; Cadieux, J. R. (Washington Univ., St. Louis). Environ. Sci. Technol.; 8: No. 6, 585-587(Jun 1974).

The relative and absolute rare earth element (REE) concentrations of atmospheric particulate matter are still very poorly known. The REE do not constitute an apparent health hazard, although their toxicology is not well defined. However, as a tool for determining sources and particulate formation processes, they warrant further study. Analyses for La, Ce, Nd, Sm, Eu, Gd, Tb, Yb, and Lu (sufficient to define relative distribution patterns) are reported for three air particulate samples collected in the metropolitan St. Louis area. Differences are observed that, with additional data, should prove useful in defining source materials and modes of atmospheric particulate loading. (auth)

9038 COINCIDENCE SPECTROMETRY DURING THE DETERMINATION OF CHLORINE IN SPECIAL PURITY NITRIC ACID. Smakhtin, L. A.; Filippova, N. V. (Scientific-Research Physical-Chemistry Inst., Obninsk, USSR). Zh. Anal. Khim.; 29: No. 3, 538-543(Mar 1974). (In Russian).

Optimal conditions were found for recording the coincidence conditioned by ^{38}Cl radiation against an interfering background of a cascade emitter ^{24}Na. A procedure was developed for activation determination of chlorine in nitric acid by using a spectrometer of fast-slow coincidence. The sensitivity of determining chlorine is $2 \cdot 10^{-8}$ g in the presence of $1 \cdot 10^{-5}$ g Na and $5 \cdot 10^{-9}$ g in the presence of $1 \cdot 10^{-6}$ g Na. The relative standard deviation is 0.17 when 10^{-7} g of chlorine is determined in the presence of 10^{-5} g Na. (auth)

9039 DETERMINATION OF THE CONCENTRATION PROFILE OF SODIUM IN SiO_2 AND Si_3N_4 LAYERS FROM THE MNOS TECHNOLOGY BY NEUTRON ACTIVATION ANALYSIS. Kotas, P.; Simkova, M. (Vyzkumny Ustav Pro Sdelovaci Techniku Novodvorska, Prague). Elektrotech. Cas.; 25: No. 1-3, 46-52 (1974). (In Czech).

The dependence of sodium concentration on the distance from the dielectric surface and on the distance from the $SiO_2(Si_3N_4)$-Si interface was investigated by means of the neutron activation analysis. Wafers of n-type silicon single crystal with SiO_2 and Si_3N_4 layers of thicknesses up to 100 nm were irradiated in the neutron flux of a nuclear reactor. After finishing the irradiation the various layers were taken off by the aid of hydrofluoric acid and phosphoric acid and sodium in them was determined by measuring gamma radiation. The results are presented in the form of concentration profiles. The sensitivity of the method is 1×10^{-12} g sodium. The results of determination were compared with electric measurements of C-V high-frequency characteristics. (auth)

9040 INSTRUMENTAL ANALYSIS IN ENVIRONMENTAL CHEMISTRY: LIQUID AND SOLID PHASE DETECTION SYSTEMS. Stedman, D. H.; Meyers, P. A. (Univ. of Michigan, Ann Arbor). Bioscience; 24: No. 6, 346-349(Jun 1974).

The following methods are discussed in view of the applicability to environmental chemistry: liquid chromatography; infrared analysis; UV and visible methods; CSR and NMR; electroanalytical techniques; neutron activation; and x-ray fluorescence. (LK)

9041 DETERMINATION OF LIGHT ELEMENTS (Z < 10) USING NEUTRON AND γ-RAY ACTIVATION. Mignonsin, E. P. (Univ., Liege). Ind. At. Spatiales; 17: No. 5, 13-29(Sep 1973). (In French and English).

Sensitive, selective and exact analytical methods are required for the analysis of elements in the trace state in voluminous samples. Activation analysis is often the only method capable of resolving particular problems in determination of light elements. In the cases where neutron activation is possible, quantities ranging between 10 and 500 micrograms can be determined. γ-ray activation analysis is sensitive and selective and capable of detecting between 10^{-2} and 10 micrograms. The advantages and disadvantages of these techniques for the analysis of light elements (Z < 10) are discussed. (FR)

9042 APPLICATION OF NEUTRON ACTIVATION ANALYSIS WITH CALIFORNIUM-252 TO THE MEASUREMENT OF SILVER IN ANCIENT COINS. Katz, S. A. (Rutgers-The State Univ., Camden, NJ). Lab. Pract.; 23: No. 3, 112-113(Mar 1974).

A small ^{252}Cf source has been used to estimate the silver content of ancient coins by neutron activation analysis. The neutron source was housed in a paraffin-filled tank and surrounded by 8 equivalent "activation tubes". By careful control of activation time and the subsequent cooling period, a high degree of selectivity in inducing and detecting radioactivity in silver was possible. To overcome the problem of self-shielding arising from the coins of non-uniform thickness, silver foils were employed to standardize the equipment. This approach provided a simple, convenient and nondestructive evaluation of the silver content of ancient coins with an accuracy of ±5%. (UK)

9043 METHODS OF SIMULTANEOUS DETERMINATION OF NON-METALLIC IMPURITY CONTENTS OF VARIOUS ORIGIN BASED ON THE USE OF RADIOACTIVE ISOTOPES. Kolaski, G.; Siewierski, E.; Vieczorek, E. (Institut fuer Eisenmetallurgie, Gliwice, Poland). Isotopenpraxis; 9: No. 10, 369-373(Oct 1973). (In German).

A neutron activation method for the determination of non-metallic impurities in metals, particularly steel, using non-radioactive oxides of La, Sm, Sc, and Lu as tracers was developed. The use of the method in the study of the passage of slag and refractory materials in steel, for a comparison of the corrosion rate of different refractories, and for the study of the non-metallic inclusions in steel was described. (JSR)

9044 NEUTRON ACTIVATION ANALYSIS OF TRACES OF GOLD IN PURE SILVER USING SULFUR AS A PRECONCENTRATION AGENT. Hirose, A.; Ishii, D. (Nagoya Univ., Japan). J. Radioanal. Chem.; 20: No. 1, 17-26(1974).

In this method for the determination of traces of gold in silver, the sulfur produced by decomposition of silver (matrix) sulfide precipitate with nitric acid was used as a preirradiation concentration agent. As the activated sulfur does not interfere with the γ spectrometry, the γ radioactivity of ^{198}Au in the activated sulfur sample was counted directly with a Ge(Li) detector without post-irradiation chemical treatment. The chemical yield of gold was more than 99%, and the concentration factor was 5 to $6 \cdot 10^3$. The analytical results of gold in 99.9 and 99.999% silver were 1.6 to 2.5 and 0.015 to 0.024 ppM, respectively. (auth)

9045 NEUTRON ACTIVATION ANALYSIS OF RHENIUM IN ROCKS AND SEDIMENTS BY EXTRACTION CHROMATOGRAPHY ON A PYRIDINE-KEL-F COLUMN. Terada, K.; Yamanaka, S.; Kiba, T. (Kanazawa Univ., Japan). J. Radioanal. Chem.; 20: No. 1, 27-39(1974).

A simple method for the determination of rhenium in rocks and sediments was established. After a neutron-irradiated sample was decomposed by $NaOH-Na_2O_2$ fusion, the alkaline solution was fed onto a column of the mixed solvent pyridine-benzene (7 : 3 v/v) supported on Kel-F powder. By passage through the column of 4.5 N NaOH solution that had been equilibrated with the solvent mixture, perrhenate ion remained on the column, but other nuclides were eluted. Subsequently, the perrhenate ion on the column could be eluted with a small amount of distilled water, and precipitated as tetraphenylarsonium perrhenate for counting the γ-activity of ^{186}Re. By the present method 0.1 ng of rhenium could be determined with a recovery of 90 to 95% and an error of ±10%. (auth)

9046 DETERMINATION OF SILICON IN CAST IRON BY 14-MeV NEUTRON ACTIVATION. High Resolution Gamma-Ray Spectrometry with a ^{56}Mn Internal Standard. Chiba, M.; Inoue, Y. (National Research Inst. for Metals, Tokyo). J. Radioanal. Chem.; 20: No. 1, 83-100(1974).

Silicon in cast iron was analyzed by 14-MeV neutron activation and high-resolution γ spectrometry. Silicon was detected as ^{28}Al, the product of the $^{28}Si(n,p)^{28}Al$ reaction. Interference of ^{56}Mn was separated using a Ge(Li) detector and a biased amplifying system. The 1.81 MeV gamma-radiation of ^{56}Mn, which is the product of the $^{56}Fe(n,p)^{56}Mn$ reaction of the matrix of cast iron, was used as an internal standard and for correction of the self-absorption of the 1.78 MeV gamma-radiation of ^{28}Al by the sample. The interferences of aluminium, phosphorus, and manganese could be neglected according to the results calculated from their nuclear properties and contents in the cast iron of this experiment. The results of this method agreed well with the results of the usual chemical method, with errors less than 5% of the results, and the

precision of the method was satisfactory with a C.V. of less than almost 6% for rapid analysis of silicon in cast iron. The analytical line through the origin with a slope of the mean value of the repetition experiments could be used as the analytical line with almost the same precision and accuracy of the results as for the analytical line calculated by the least squares method. (auth)

9047 14-MeV NEUTRON ACTIVATION ANALYSIS OF SODIUM, ALUMINIUM, PHOSPHORUS, AND CHROMIUM IN AN AQUEOUS FLOWING SYSTEM, Bibby, D. M.; Oldham, G. (Loughborough Univ. of Tech., Eng.). J. Radioanal. Chem.; 20: No. 1, 101-111(1974).

Using activation by 14-MeV neutrons, quantitative analysis was carried out for Na, Al, P, and Cr in flowing aqueous solutions, with a reproducibility of ±5%. Limits of detection of 3100, 30, 20, and 50 ppM were obtained for the four elements respectively, the high value for Na showing the effect of matrix interference. Mixtures of the four elements were also analyzed. Interferences between the isotopes produced were minimized by using the fact that maximum activity is detected at a characteristic flow-rate for each isotope. A semi-empirical formula was derived for this system to calculate the detected activity as a function of flow-rate, for all isotopes. (auth)

9048 SUBSTOICHIOMETRY IN NEUTRON ACTIVATION ANALYSIS. Nadkarni, R. A. (Cornell Univ., Ithaca, NY). J. Radioanal. Chem.; 20: No. 1, 139-158(1974).

A review is presented on the work done in development and applications of the substoichiometric techniques in neutron activation analysis. (auth)

9049 COMPILATION OF PHOTONUCLEAR REACTION PRODUCTS AND ASSOCIATED GAMMA-ENERGIES. Toms, M. E. (Naval Research Lab., Washington, DC). J. Radioanal. Chem.; 20: No. 1, 177-381(1974).

High-energy bremsstrahlung from high-intensity electron linacs can produce activation through a variety of photonuclear reactions. A great range of activities by half-lives can be used. Some discrimination between target elements can be obtained through the choice of bremsstrahlung end-point energy. The high resolution of Ge(Li) gamma spectrometers permits much of the analysis to be accomplished without chemical separation of resulting nuclei; hence, non-destructive analysis can be applied to many materials. To facilitate the use of such analysis, a compilation of photonuclear reactions with their resulting gamma rays has been prepared. (auth)

9050 NITROGEN DETERMINATION IN BIOLOGICAL MATERIALS BY THE NUCLEAR TRACK TECHNIQUE. Carpenter, B. S.; LaFleur, P. D. (National Bureau of Standards, Washington, DC). Anal. Chem.; 46: No. 8, 1112-1113(Jul 1974).

The nitrogen content of SRM 1571 orchard leaves and SRM 1577 bovine liver is determined by the nuclear track technique and compared with values obtained using the Kjeldahl method. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 9251, 9265, 9483, 9663, 10064, 10075, 10182, 10306, and 10570.

9051 (LA-5497) DETERMINATION OF CARBON, HYDROGEN, AND TRITIUM IN IRRADIATED REACTOR FUELS AND CLADDING MATERIALS. MacDougall, C. S.; Marshall, T. K.; Matlack, G. M.; Waterbury, G. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Dec 1973. Contract W-7405-eng-36. 10p. Dep. NTIS $4.00.

A reliable gravimetric method for determining carbon and hydrogen was adapted for analyses of irradiated fuels and claddings in a hot cell. The sample was burned in oxygen at 1000°C in a furnace system within the hot cell to oxidize hydrogen to water and carbon to carbon dioxide. The evolved gases were swept through heated tubing into magnesium perchlorate to trap the water and into Ascarite to trap the carbon dioxide, and the traps were subsequently weighed. The bias in measuring either carbon or hydrogen was consistently −2.5%, and the relative standard deviations were 4.4% in measuring hydrogen and 3.0% in measuring carbon. The same furnace system was used to determine tritium in a separate portion of the sample. This portion was reacted with moist oxygen at 1000°C, and the tritiated water was collected in a spiral trap cooled to −80°C. This trap was then heated to 200°C, and the tritiated water was swept by argon into a volumetric flask containing distilled water. An aliquot of the water was pipetted into a scintillation vial filled with Aquasol and the mixture was counted. The relative standard deviation of this method was ±10% for measuring 0.1 μg of tritium, and the bias was −4%. (auth)

9052 (ORO-4254-19) USE OF ORGANIC COMPLEXES IN EXTRACTIONAL PHOTOMETRIC AND FLUORIMETRIC DETERMINATION OF URANIUM FROM AQUEOUS SYSTEMS. Mehry-Mirhashemi. (Oklahoma State Univ., Stillwater (USA)). 1972. Dep. NTIS $4.00.

In a variety of methods presented for determination of uranium in water (which is usually a uranyl tricarbonate ion $[UO_2(CO_3)_3]^{-4}$, having an instability constant of $(1.7 \pm .6) \times 10^{-23}$) extractional photometric and fluorimetric methods were studied by the use of Rhodamine B and Arsenazo III. Both gave a good result for extraction with a high sensitivity. The role of addition of EDTA removed the effect of interfering metal ions and increased the accuracy of the methods. (auth)

9053 (UCRL-51558) FEASIBILITY OF ISOTOPIC ABUNDANCE MEASUREMENTS USING RAMAN SCATTERING. Harney, R. C.; Bloom, S. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Apr 1974. Contract W-7405-eng-48. 12p. Dep. NTIS $4.00.

The possibility of using gas-phase Raman scattering of laser beams for measuring the isotopic abundances of light elements is studied. A design for a Raman scattering isotopic abundance spectrometer is presented, and the data collection rate for a natural isotopic abundance determination in nitrogen gas is calculated. An analysis of noise sources indicates that isotopic variations of less than 100 parts per billion may be measured in times of the order of a few minutes. It appears that laser Raman scattering should be a valuable new tool for precision assays of isotopic abundance ratios. (auth)

9054 (UCRL-Trans-10709) DETERMINING URANIUM IN URINE SPECIMENS AFTER SEPARATION BY ANION EXCHANGE. Korkisch, J.; Steffan, I. Translated from Mikrochim. Acta; No. 2, 273-278(1973). 8p. Dep. NTIS $4.00.

A separation method that is generally applicable for uranium in the analysis of urine specimens is described. This is based on the adsorption of the uranium on the strongly basic anion exchanger Dowex 1, X8 from human urine that has been strongly acidified with hydrochloric acid, whereby most of the organic components, phosphoric acid, and most mineral urine components are removed. Thus it becomes possible to separate the uranium compounds rapidly and simply without prior evaporation of the urine and destruction of the organic compounds. If need be, the foreign ions that are adsorbed along with the uranium, such as iron and also adsorbed urine coloring materials, are removed through subsequent washing of the resin with a mixture of 50 vol.% tetrahydrofurane, 40 vol.% methylglycol and 10 vol.% 6N hydrochloric acid, and the uranium is eluted with 1N hydrochloric acid. The determination of the uranium in the eluate can then be conducted without interference by the fluorometric method. (auth)

9055 (Y-1944) PREPARATION OF LITHIUM ISOTOPIC STANDARDS. Barringer, R. E. (Oak Ridge Y-12 Plant, Tenn. (USA)). 23 May 1974. Contract W-7405-eng-26. 20p. Dep. NTIS $4.00.

A method was developed for the precise preparation of lithium isotope standards in the range of 20 to 97 at. % lithium-6. Standards were prepared by carefully weighing and mixing isotopically pure lithium-6 and lithium-7 sulfates. A statistical limit of error (0.95) of ≤±0.0025 at. % lithium-6 was achieved. (auth)

9056 INVESTIGATION OF THE COMPLEX FORMATION OF SCANDIUM WITH N CINNAMOYL-PHENYLDROXYLAMINE USING THE AMPEROMETRIC TITRATION METHOD. Scheina, H. M.; Gallai, S. A.; Schwedene, H. W.; Dittrich, N. W. (Moscow State Univ.). Anal. Lett.; 7: No. 2, 125-132(1974). (In German).

An amperometric study has been made of the new organic reagent N-cinnamoyl-phenylhydroxylamine (CPHA). It is possible to use the CPHA oxidation current for detecting the end point in an amperometric titration in spite of the complex nature of the electrode process. Amperometric study of the complexation of scandium with CPHA showed that a complex of constant composition was formed in the pH range of 6.5−7.0. The ratio of Sc : CPHA was 1 : 3. The solubility of the complex under titration conditions has been determined. (auth)

9057 ATOMIC ABSORPTION AND ATOMIC FLUORESCENCE SPECTROMETRY. Volume 1. 3rd International Congress, Paris, France, September 27−October 1, 1971. New York; John Wiley and Sons, Inc. (1973). 412p. (In several languages). (CONF-710992-P1).

Five of the 32 papers presented at this conference were abstracted and indexed separately. One paper was previously abstracted for NSA and appeared as abstract 28:17870. (LK)

For abstracts of individual papers see: 9058−9062.

9058 INTERFERENCES IN THE DETERMINATION OF TRANSITION ELEMENTS BY ATOMIC ABSORPTION SPEC-

TROMETRY. Ottaway, J. M.; Coker, D. T.; Davies, J. A.; Harrison, A.; Pradhan, N. K.; Rowston, W. B. (Univ. of Strathclyde, Glasgow). pp 107-123 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 1. New York; John Wiley and Sons, Inc. (1973).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P1.

The occurrence of interferences in the atomic absorption determination of a number of transition elements is reviewed with particular emphasis on the effects of experimental parameters such as flame composition, the height of the optical beam above the burner, the nature and concentration of the interfering ion, and the accompanying anion. In the case of each element studied, a procedure has been developed which allows the interference-free determination to be carried out in an air-acetylene flame with the aid of suitable releasing agents. Brief comments are made on the mechanism of the interference phenomena particularly the mutual interference effects of chromium and calcium. (auth)

9059 HIGH TEMPERATURE FLAMES OF NO/C_2H_2, N_2O/C_2H_2, AND N_2O/H_2 GAS MIXTURES IN ATOMIC ABSORPTION SPECTROSCOPY FOR GEOCHEMICAL ANALYSIS. Luecke, W. (Univ., Karlsruhe, Ger.). pp 139-146 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 1. New York; John Wiley and Sons, Inc. (1973).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P1.

The applicability of the high temperature flames of the two-gas mixtures NO/C_2H_2 and N_2O/H_2 to the atomic absorption spectroscopy analysis of the alkaline earth metals and those elements that form refractory oxides was investigated. Both flames exhibit some advantages over the well known N_2O/C_2H_2 flame in cases, such as Mg, Ca or Al in silicate analyses, where the concentrations of these elements are too high for direct determination, and the respective solutions consequently have to be diluted. For determination of trace concentrations of B, Ba, Sr, and Zr, the NO/C_2H_2 gas mixture is recommended, whereas that of N_2O/C_2H_2 is favored for Be, Ti, and V. (auth)

9060 ATOMIC ABSORPTION SPECTROPHOTOMETRIC DETERMINATION OF TRACE ELEMENTS BY THE FILAMENT TECHNIQUE. Hircq, B. (CEA, Montrouge, France). pp 199-217 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 1. New York; John Wiley and Sons, Inc. (1973). (In French).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P1.

An atomic absorption cell fitted with an atom generator, which appears as a metal or carbon filament on which a few microliters of solution have been deposited, was developed. After having studied the influence of the argon flow which scans the cell, and of the filament temperature, on the amplitude of the absorption peaks, an aqueous solution calibration in presence of uranium was realized for a series of elements. In this series the detection limits correspond to quantities of deposited element from 0.1 pg to a few nanograms, and for about ten elements to quantities lower than 1 ng. (auth)

9061 ATOMIC ABSORPTION FLAME PHOTOMETRIC ANALYSIS OF TRACE ELEMENTS EMPLOYING THE IMPULSE EVAPORATION FROM A MICROZOND. Prudnikov, E. D. (Leningrad State Univ.). pp 315-319 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 1. New York; John Wiley and Sons, Inc. (1973).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P1.

Use of the impulse sample evaporation in the flame from a microzond allows detection of trace elements by atomic absorption and emission flame photometric methods. Detection limits reach 10^{-10}-10^{-12} g and less for many elements. Cd, Zn, Pb, Cu, Ag, Sr, Eu, etc. can be determined by this method to 0.01 to 10 ppm and less in macro- and microsamples of different materials. (auth)

9062 APPLICATION OF ATOMIC ABSORPTION SPECTROPHOTOMETRY TO GEOCHEMICAL PROBLEMS: DETERMINATION OF SEVEN MAJOR ELEMENTS AND FIVE TRACE ELEMENTS. Dupuy, C.; Savoyant, L. (Univ., Montpellier, France). pp 381-388 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 1. New York; John Wiley and Sons, Inc. (1973). (In French).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P1.

Seven major elements (Al, Fe, Mn, Ca, Mg, Na, K) and five trace elements (Sr, Ni, Cr, Cu, Zn) were analyzed quantitatively by atomic absorption spectroscopy in silicate rocks and minerals. Experimental procedure, interference study, and standard solution preparation are described. Determinations on "geochemical standards" are presented and discussed. Simplicity and speed are the characteristics of this atomic absorption routine procedure. Its application is very large since it covers all types of silicate rocks and minerals. (auth)

9063 ATOMIC ABSORPTION AND ATOMIC FLUORESCENCE SPECTROMETRY. Volume 2. 3rd International Congress, Paris, France, September 27-October 1, 1971. New York; John Wiley and Sons, Inc. (1973). 541p. (In several languages). (CONF-710992-P2).

Seven of the 37 papers presented at the conference were abstracted and indexed separately. (LK)

For abstracts of individual papers see: 9064-9069 and 10306.

9064 USE OF ATOMIC ABSORPTION FOR WATER ANALYSIS. Boucetta, M.; Fritsche, J. (Bureau de Recherches Geologiques et Minieres, Orleans, France). pp 401-408 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 2. New York; John Wiley and Sons, Inc. (1973). (In French).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P2.

A great number of previously existing problems, such as accuracy, detection limit and rapidity could be solved by application of the atomic absorption method to water analysis. This study was started by use of the conventional atomic absorption method when the required detection limits were sufficient: it was true for the following elements: Ca, Mg, Na, K, Sr, Li, Rb, Cs, Si and sometimes: B, Fe, Mn, Pb, Zn, Cu, Co, Ni, Cd, Cr, Mo, Ag, Au, Hg. This limit could be improved by extraction through organic solvent up to percentages of a few $\mu g/l$ (ppB) for the following elements: Pb, Zn, Cu, Cr, Ni, Fe, Mn, B, Cd, Cr, Mo, Ag, Au, Hg. The data collection on teleprinters (punched tape) allows an automatic processing of results, which takes into account an eventual shift of the base line and of the calibration. In order to reach extreme detection limits, or when the volume of the available sample is particularly low, we resort to a graphite oven as an atomization source. In this case, the test taking is lower or equal to 100 μl (often 10 μl) of water or organic extract obtained as previously. This method of operation does not allow results to be obtained on teleprinter nor their automatic processing by computer. (auth)

9065 APPLICATION OF ATOMIC SPECTROSCOPY TO THE ANALYSIS OF BIOLOGICAL MATERIALS. Alexander, F. W.; Delves, H. T.; Reeson, R. B. (Hospital for Sick Children, London). pp 561-576 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 2. New York; John Wiley and Sons, Inc. (1973).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P2.

Children with certain disorders of metabolism, such as phenylketonuria or secondary disaccharide intolerance must receive strictly controlled synthetic diets for varying periods in their early years of life. These diets should contain amino acids, carbohydrates, vitamins, and all the essential minerals and trace elements, but little is known of the essential requirement by children for trace metals. Trace metal balances have therefore been carried out for a group of normal children receiving normal diets and for a group of phenylketonuric children receiving synthetic diets. The concentrations of thirteen metals, Fe, Cu, Zn, Co, Mn, Mo, Cr, Ca, Mg, Sr, Ni, Cd, and Pb were determined in the dietary intake and urinary and faecal output of these children over three-day periods. Samples of whole blood were also analyzed. The application of conventional flame atomic absorption spectrophotometry to the analysis of the diets and excreta is described, together with the use of an inexpensive "home-made" carbon tube furnace atomizer for the analysis of microliter volumes of blood samples. The results of the balance studies are discussed. (auth)

9066 PROBLEMS IN THE DETERMINATION OF SMALL QUANTITIES OF STRONTIUM IN BIOLOGICAL MEDIA. El Solh, N.; Rousselet, F.; Girard, M. L. (Faculte de Pharmacie, Paris). pp 599-631 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 2. New York; John Wiley and Sons, Inc. (1973). (In French).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P2.

In biological media, strontium is an element that is difficult to be determined with accuracy through atomic absorption spectroscopy in view of the plurality of interactions acting on the atomization efficiency. This efficiency is essentially variable depending upon the chemical matrix, composition, temperature and configuration of the flame, each of these parameters being apparently in-

fluenced by the other ones. For example, by a simultaneous addition of La^{3+} and NO_3^- ions to a solution of Sr^{2+} ions, it can be observed that the overall interaction becomes dependent on the flame characteristics: with an oxidizing flame, the positive effect of lanthanum is preponderating while the negative effect of acid dominates with a reducing flame. It appears thus necessary that the experimenter should study by himself, by means of his own installation, and according to the configuration of the burner used, the conditions of the smallest matrix effects, these conditions being not necessarily in correspondence with the achievement of the highest sensitivity. (auth)

9067 INTERFERENCES AND THEIR SUPPRESSION IN ANALYSIS OF SILICATES BY ATOMIC ABSORPTION SPECTROPHOTOMETRY: OPTIMAL CONDITIONS FOR ANALYSIS OF CEMENTS. Tenoutasse, N. (CNRS, Brussels). pp 817-842 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 2. New York; John Wiley and Sons, Inc. (1973). (In French).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P2.

Atomic absorption spectrophotometry (AAS) is an interesting method for the analysis of industrial silicates, such as cements and clays. During the analysis of these silicates by AAS one observes the formation of refractory compounds, especially aluminates and silicates, having high melting points. It is evident that the formation of these compounds decreases the accuracy of the determinations. We are particularly interested in the analysis of cements by AAS. Some workers carry out a precipitation of silica in order to suppress the formation of calcium silicates in the flame. It seemed useful to describe a method of analysis which enables the determination of all the oxides from a single solution of a dissolved sample. The chemical interferences have been studied in some systems having the same relative ratios of different oxides as Portland cement; we have observed the formation of the silicate and aluminate of calcium in the flame; there is no formation of a silico-aluminate. The use of a mixture of HF and HCl for the dissolution of the silicates enables not only the dissolution of cement but HF (the excess is complexed by H_3BO_3) seems to play an active part in the suppression of the chemical interferences, particularly in the determination of silica. Under these conditions, the use of La is no longer necessary (except for the determination of Al and Ti). The use of HF and HCl for dissolving cements introduces no foreign cation and all the constituents of the cement are able to be determined from a single solution. This method has been used for the determination of the following oxides in cements: CaO, SiO_2, Al_2O_3, Fe_2O_3, MgO, K_2O, Na_2O, Mn_2O_3, SrO, and TiO_2. The accuracy of the determination of these oxides is quite satisfactory: the reproducibilities of determinations by AAS are at least as good as those obtained by gravimetry. (auth)

9068 ANALYSIS OF RADIOACTIVE OR TOXIC PRODUCTS WITH A KING OVEN: APPLICATION TO DETERMINATION OF TECHNETIUM IN FISSION PRODUCTS. Baudin, G.; Bonne, R.; Chaput, M.; Feve, L. (CEA, Fontenay-aux-Roses, France). pp 853-870 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 2. New York; John Wiley and Sons, Inc. (1973). (In French).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P2.

The atomic absorption flameless spectroscopy allows the analysis of technetium with an absolute limit of sensitivity in the order of 10^{-8} g. The analysis installation realized has been designed for analyzing radioactive products; (inside a glove box are located: an atomization graphite oven, a removable hollow cathode loaded with technetium oxide as well as a deuterium continuous spectrum auxiliary lamp, which allows elimination of the detrimental effects of molecular absorptions). The proposed mode of operation makes allowance for the presence of most other fission products likely to accompany it. The method allows determination of a technetium percentage of 1 to 2 μg/ml (i.e., 1% in relation to the fission product). (auth)

9069 DETERMINATION OF METALLIC IMPURITIES IN HIGHLY ENRICHED SOLUTIONS OF URANIUM BY ATOMIC ABSORPTION WITH PRELIMINARY SEPARATION OF URANIUM BY PARTITION CHROMATOGRAPHY. Pagliai, V.; Pozzi, F. (CNEN, Saluggia, Italy). pp 907-921 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 2. New York; John Wiley and Sons, Inc. (1973). (In French).

From 3rd international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P2.

It is a question of describing an analysis methodology for a few metal impurities (Al, Ca, Cd, Cu, Cr, Fe, Li, Mg, Na, Ni) into solutions of uranyl nitrates highly enriched, coming from a reprocessing plant of irradiated combustibles. The uranium matrix is previously eliminated by means of chromatography reverse-stage separation (solid phase Kel-F; stationary phase TBP); the elutriation product containing the impurities is analyzed by means of a Perkin-Elmer Model 303 atomic absorption spectrophotometer. This simple and rapid method allows determination of impurities in enriched uranium solutions, without a complicated restructuration of the device. (auth)

9070 DETECTION OF SYNTHETIC VANILLIN IN VANILLA EXTRACTS BY ISOTOPIC ANALYSIS. Bricout, J.; Fontes, J. C.; Merlivat, L. (Institut de Recherches Appliquees aux Boissons, Creteil, France). J. Ass. Offic. Anal. Chem.; 57: No. 3, 713-715 (May 1974).

The isotopic composition of vanillin was investigated in order to distinguish synthetic wood lignin vanillin and natural vanilla-extracted vanillin. Natural vanillin is enriched in deuterium and carbon-13 as compared to synthetic vanillin. This enrichment probably results from differences in the synthetic pathways of this compound. In particular, carbon isotope fractionation is associated with photosynthesis; this fractionation lowers the $^{13}C/^{12}C$ ratio by about 20‰, relative to atmospheric carbon dioxide, for the Calvin cycle in photosynthetic carbon dioxide fixation, which occurs in trees. The fractionation factor is even lower, about 13‰, for the orchid Vanilla planifolia Andrews in which the Crassulacean acid metabolic pathway probably operates. (auth)

9071 RECENT DEVELOPMENTS IN THE ANALYSIS OF TOXIC ELEMENTS. Lisk, D. J. (Cornell Univ., Ithaca, NY). Science; 184: No. 4142, 1137-1141 (14 Jun 1974).

Methods for analyzing toxic elements are reviewed. The methods used most often are: atomic absorption, gas-liquid chromatography, emission spectrometry, fluorescence analysis, neutron activation analysis, polarography, colorimetry, and anodic stripping voltametry. (LK)

9072 EFFECT OF MIXED SOLVENTS ON DETERMINATION OF IODINE BY SODIUM THIOSULFATE SOLUTION WITH POTENTIOMETRIC DETECTION OF AN END POINT. Ramadan, A. A.; Agasyan, P. K.; Petrov, S. I. (Moscow State Univ.). Zh. Anal. Khim.; 29: No. 3, 544-550 (Mar 1974). (In Russian).

The effect of different water contents in methanol, ethanol, isopropanol or acetonitrile on the shape of the curves of potentiometric titration of I_2 with sodium thiosulfate was studied. The position of the first jump on the titration curves depends, as in the case of individual solvents, on the formation constant in these media. The effect of a starting iodine concentration ($C_{I_2}^0$) on the shape of its titration curves has been examined. It has been shown experimentally and by calculation that the value of the first jump on the curves decreases with increasing $C_{I_2}^0$ while the second jump value increases. Within certain limits of titrated iodine concentrations a common intersection point of the titration curves is observed which position and $C_{I_2}^0$ limits are connected with the formation constant of I_3^- in this medium. Optimal conditions have been established for quantitative titration of iodine with sodium thiosulfate in mixed solvents. (auth)

9073 EXTRACTION-AMPEROMETRIC DETERMINATION OF PHOSPHORUS BY MEANS OF FERROCENE. Solomatin, V. T.; Artemova, T. N.; Yakovlev, P. Ya. (Central Scientific-Research Inst. of Ferrous Metallurgy, Moscow). Zh. Anal. Khim.; 29: No. 3, 525-528 (Mar 1974). (In Russian).

The amperometric titration of Mo(VI) and 12-molybdophosphate with ferrocene solution was examined in water–acetone–isobutanol–hydrochloric acid media. In such a medium 6N in HCl molybdenum(VI) is determined in 12-molybdophosphate and, therefore, phosphorus from molybdenum(VI). The sensitivity of the determination is 1 μg P in 20 ml of the solution titrated during the titration with 0.001 M ferrocene solution. The error is not more than 5-8%. A highly sensitive extraction-amperometric procedure has been developed for determining phosphorus from molybdenum in steel without separation of chromium. (auth)

9074 KINETIC DETERMINATION OF RUTHENIUM ON THE BASIS OF OXIDIZING COPPER(II) WITH PERIODATE. Rozovskii, G. L.; Poshkute, Z. A.; Prokopchik, A. Yu. (Inst. of Chemistry and Chemical Tech., Vilnius, USSR). Zh. Anal. Khim.; 29: No. 3, 512-517 (Mar 1974). (In Russian).

A kinetic method for determining ruthenium ($4 \cdot 10^{-9}$ to $9 \cdot 10^{-8}$ M) is suggested. The method is based on its catalytic effect on oxidizing copper(II) in alkaline solutions with the formation of intensely colored diperiodatocuprate(III). The reaction kinetics were examined and optimal analytical conditions found. (auth)

9075 DETERMINATION OF RARE EARTHS IN AMERICIUM BY USING A HOLLOW CATHODE. Zakharov, E. A.; Myasoedov,

B. F.; Karyakin, A. V.; Ozhegov, P. I. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Anal. Khim.; 29: No. 3, 459-465(Mar 1974). (In Russian).

A discharge in a hollow cathode as a source of excitation and spectrographic instruments of mean dispersion with a 3-lens condenser system make it possible to determine $1 \cdot 10^{-6}$ to $1 \cdot 10^{-7}$ g Eu, Sm, Nd, La, Pr with the coefficient of variation 19 to 25%. The intensity of rare earth lines strongly depends on the pressure of the carrier-gas (helium). It is minimum under the pressure 15 m. c. m. and increases with decreasing helium pressure. In a carbon hollow cathode lanthanides enter the discharge plasma from solid carbides. In the case of lanthanum a simultaneous entrance as a result of dissociation of gaseous LaO is possible and more probable. (auth)

9076 SPECTROGRAPHIC DETERMINATION OF RARE EARTHS IN ALUMINUM, YTTRIUM, LANTHANUM, AND GADOLINIUM VANADATES. Karpenko, L. I.; Fadeeva, L. A.; Shevchenko, L. D. (Inst. of General and Inorganic Chemistry, Odessa). Zh. Anal. Khim.; 29: No. 3, 454-458(Mar 1974). (In Russian).

The effect of Y, La, Gd, Al, V was studied in processes of spark analysis of solutions containing rare earths. The presence of large amounts of the components enumerated in the spark discharge plasma causes a decrease in the discharge temperature and leads to a change of conditions for exciting line spectra of neutral and ionized atoms of rare-earth microcomponents. A general spectrographic method was worked out for determining individual rare earths in yttrium, lanthanum, gadolinium, and aluminium vanadates with the sensitivity of 0.1 to 0.001 mg/ml; the coefficient of variation is 8 to 10%. (auth)

9077 EXTRACTION-PHOTOMETRIC DETERMINATION OF MICROIMPURITIES OF COPPER, NICKEL, AND IRON IN GADOLINIUM AND LEAD MOLYBDATES. Sizonenko, N. T.; Belenko, L. E.; Soroka, L. I. (All-Union Scientific-Research Inst. of Monocrystals, Scintillation Materials, and Special Purity Substances, Kharkov). Zh. Anal. Khim.; 29: No. 3, 446-449 (Mar 1974). (In Russian).

Extraction-photometric determination of copper, nickel and iron in lead and gadolinium molybdates of high purity and monocrystals based on them is suggested. The determination minimum is $2 \cdot 10^{-5}$ with a 1-g sample. (auth)

9078 METHODS OF LABELING REFRACTORIES TO DETERMINE THE ORIGIN OF NON-METALLIC INCLUSIONS IN STEEL. Cymorek, J. Isotopenpraxis; 10: No. 1, 30-31(Jan 1974). (In German).

The use of La as an inactive tracer for the study of inclusions in steel was studied using acetate solutions of La. The steel samples to be analyzed were placed in the solutions and then dried in air and an oven. The La content of the samples was determined from the mass increase, and the distribution of the La in the body of the sample was determined. These results showed that the distribution is not homogeneous and this method can be used only if the requirements on homogeneity of the indicator distribution are not high. (JSR)

9079 CONTRIBUTION TO THE OPTIMIZATION OF THE EMISSION-SPECTROMETRIC ^{15}N ANALYSIS. Mueller, G. (Zentralinstitut fuer Isotopen- und Strahlenforschung, Leipzig). Isotopenpraxis; 9: No. 10, 365-367(Oct 1973). (In German).

The extinction curves for quartz, ultraviolet-transmitting glass, and rasotherm glass were measured and the differences in the extinction coefficients were calculated. The practical effect of the differences in the extinction coefficients on the accuracy of ^{15}N analysis was shown by three examples. The results indicated that with the use of ultraviolet-transmitting glass the relative error could be limited to 0.5%. (JSR)

9080 DETERMINATION OF URANIUM IN Ni ALLOYS BY PHOTOMETRIC TITRATION. Matous, K.; Tomik, B. (Vysoka Skola Banska, Ostrava, Czech.). Hutn. Listy; 28: No. 9, 663-664(1973). (In Czech).

Uranium in Ni alloys was determined by photometric titration with ammonium vanadate using phenylanthranilic acid and barium diphenylamino sulfonate as indicators, without separating Ni. Uranium was reduced by means of metallic Bi. The method of determination is described; it is rapid, simple and yields reliable results. (INIS)

9081 ASSAY OF PESTICIDE RESIDUES BY MASS SPECTROMETRY AND POTENTIALITIES OF STABLE-ISOTOPE-LABELLED PESTICIDES FOR ENVIRONMENT STUDIES: NOTE ON ANALYTICAL TECHNIQUES. Widmark, G. (Univ., Stockholm). pp 125-127 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna: International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Advantages of the use of stable isotopes as tracers in pesticide research are discussed. Full utilization of their potential requires a combination of gas-liquid chromatography, mass spectrometry and computerized data processing. Special techniques are described which allow focusing of the recording capacity on a limited range of mass numbers, [i.e., alternation of accelerator voltage (AVA) and repetitive scanning]. Working experience is still required with these techniques in the low concentration range of interest to pesticide residue chemistry. (auth)

9082 SPECTROPHOTOMETRIC DETERMINATION OF NIOBIUM IN ROCKS. Greenland, L. P.; Campbell, E. Y. J. Res. U. S. Geol. Surv.; 2: No. 3, 353-355(1974).

After acid decomposition and evaporation to volatilize silica, samples containing 0.5 to 6 μg Nb are fused with pyrosulfate and dissolved in hydrochloric acid–tartaric acid. Niobium is separated by thiocyanate extraction with amyl alcohol and back-extracting from the organic solvent with dilute hydrofluoric acid. Niobium is reacted with 4-(2-pyridylazo)-resorcinol to obtain a colored species. Analytical error, estimated from replicate analyses of eight U. S. Geological Survey standard rocks, ranges from 2.9 to 6.4 percent at the 1 to 27 μg/g Nb level. (auth)

9083 EMISSION SPECTOGRAPHIC DETERMINATION OF TRACE ELEMENTS IN AIRBORNE PARTICULATE MATTER. Sugimae, A. (Environmental Pollution Control Center, Osaka). Anal. Chem.; 46: No. 8, 1123-1125(Jul 1974).

A technique for the determination of Be, Bi, Cd, Cr, Cu, Mn, Ni, Pb, Sn, Ti, V, and Zn is described. The relative standard deviation is 13% or less. (auth)

9084 REACTION OF THE RARE EARTH ELEMENTS WITH ARSENAZO-p-NO_2 REAGENT. Muk, A. A.; Pravica, M. B. (Boris Kidric Institute, Belgrade). Anal. Chem.; 46: No. 8, 1121-1122(Jul 1974).

The color reaction of individual rare earth elements was investigated spectrophotometrically. The sensitivities were different and molar absorptivities decreased from lanthanum to lutetium. (auth)

9085 STUDIES ON SEVERAL URANYL ORGANOPHOSPHOROUS COMPOUNDS IN A POLY(VINYL CHLORIDE) (PVC) MATRIX AS ION SENSORS FOR URANIUM. Manning, D. L.; Stokely, J. R.; Magouyrk, D. W. (Oak Ridge National Lab., TN). Anal. Chem.; 46: No. 8, 1116-1119(Jul 1974).

Uranyl ion sensing electrodes, which exhibit near Nernstian response, in the pH range 2 to 3.5, to uranyl ion activities from about 10^{-4} to 10^{-1} M, were investigated. Additional studies were conducted on the most favorable electrodes. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 9240, 9255, 9536, 9541, 9623, 9658, 9797, 9990, 9992, 10004, 10073, 10110, 10113, 10114, and 11587.

9086 (EUR-5117) GRETEL: A COMPUTER PROGRAM FOR GAMMA RAY SPECTROMETRY WITH Ge(Li) DETECTORS. Guzzi, G.; Cuypers, J. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Apr 1974. 76p. Dep. NTIS (US Sales Only) $7.00. EUR B. Fr. 100.-.

A computer program set up for routine batchwise processing of spectrometric data is presented. The program performs the quantitative analysis of gamma spectra obtained by Ge(Li) detectors, using special "oriented libraries," which are prepared for each particular problem. The computer routines which detect and evaluate peak areas perform the following operations: local smoothing of the spectrum; first derivative of the smoothed spectrum; peak location according to the change of sign of the first derivative; and computation of the net area of each peak found. The possibility of detecting and computing also double peaks is one of the features of the program. Results in ppM are obtained in the form of digital lists. On request a drawing of the spectrum can also be produced, showing the way in which the spectrum has been processed. (auth)

9087 (IEA-317) PROGRAM IN "BASIC" LANGUAGE FOR ANALYSIS OF GAMMA SPECTRA, USING ON-LINE MINICOMPUTERS. Lima, F. W.; Atalla, L. T. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Nov 1973. 15p. Dep. NTIS (US Sales Only) $4.00.

A program in "INSTRUMENT BASIC" language is proposed for analysis of gamma spectra obtained with Ge–Li detectors and accumulated in multichannel analyzers on-line with minicomputers. The program locates the peaks, evaluates the corresponding energy values, the net peak areas and the standard deviation of the areas. (auth)

9088 (LA-5535-C, pp 255-259) POSSIBILITY OF APPLYING MESON SPECTROSCOPY TO THE STUDY OF SOLUTION CHEMISTRY. Lietzke, M. H.; Stoughton, R. W. (Oak Ridge National Lab., TN). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

The possibility is pointed out that meson spectroscopy may offer a more direct method for measuring the structural and thermodynamic properties of both of electrolyte and of nonelectrolyte solutions is discussed. Such a method would reflect the presence of specific ionic species in solution and is needed to revolve the discrepancies. It may even be possible to obtain information on structure in solutions of a type as yet impossible to get. (JFP)

9089 (LA-5587-MS) METHOD TO ESTIMATE THE SPECIFIC FISSIONS IN ^{235}U USING A NaI CRYSTAL. Balestrini, S. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1974. Contract W-7405-eng-36. 28p. Dep. NTIS $4.00.

A technique is described to assay both the fissions and ^{235}U content in certain test samples used for critical assembly studies. The method essentially compares a pulse height analysis from a NaI well crystal scintillator with an empirical mathematical model. In the case of fissions, the analysis can be made from 6 hours to 50 days after irradiation. The listings and description are included for the computer program ASSAY, that was developed to do the computations. The listings and brochure are also included for GPLOT, a general subroutine to plot on film and which is used extensively by ASSAY. (6 figures, 2 tables) (auth)

9090 LIQUID SCINTILLATION COUNTING FOR PLUTONIUM IN ENVIRONMENTAL SAMPLES. Bokowski, D. L. (Dow Chemical Co., Golden, CO). Amer. Ind. Hyg. Ass. J.; 35: No. 6, 333-344(Jun 1974).

A liquid scintillation counting method applicable to the routine analysis of plutonium in environmental and biological samples is presented. Methods for improving the specificity and sensitivity for plutonium are discussed. The liquid scintillation method was compared to the anion exchange chromatography–alpha pulse height spectrometry method and was validated by means of a t-test. Sample preparation procedures are given for air filters, water, and soil. The expediency and ease of sample preparation are demonstrated. Overall mean recovery of plutonium from the various types of samples was better than 95%. Minimum detectable activity for 100-minute counts is 0.18 pCi. (auth)

9091 DETERMINATION OF THE COMPONENTS OF A TERNARY SYSTEM. Cecal, A. (Univ. Al. I. Cuza, Iasi). Kernenergie; 17: No. 1, 4-5(Jan 1974). (In German).

A rapid and simple method for the quantitative determination of the components of a ternary system was described. It consists of the combined measurement of the back-scattering and absorption of β^- radiation. The Na^+, Ba^{2+}, Cu^{2+} system was selected as an example. The measurement error of the method is between 0.5 and 3.5%. (tr-auth)

9092 BETA SPECTRUM ANALYSIS: A NEW METHOD TO ANALYZE MIXTURES OF BETA-EMITTING RADIONUCLIDES BY LIQUID SCINTILLATION TECHNIQUES. Oller, W. L. Ann Arbor, MI; Univ. of Michigan (1973). 154p. University Microfilms Order No. 74-3705.

Thesis (Ph. D.).

A description is given of a method to couple a liquid scintillation spectrometer to a multichannel pulse-height analyzer to record beta spectra simultaneously with three different energy ranges. Spectra of tritium, carbon-14, and phosphorus-32 that were recorded separately and simultaneously by this method are presented. Analyses of these beta spectra were performed by a least-squares technique with the results shown in tabular and graphic form. Quench corrections are made with a computer program of least-squares analysis that uses a modification of the gain restoration and channels ratio methods of quench correction. Experiments show this method of beta spectrum analysis to be a rapid and accurate method to analyze samples that contain mixtures of tritium, carbon-14, and phosphorus-32 in various proportions. The minimum detectable activities of tritium (5.5 ± 1.5 picocuries), carbon-14 (3.5 ± 1.3 picocuries), and phosphorus-32 (2.5 ± 0.9 picocuries) were determined for each nuclide by itself in an unquenched sample at the 95% confidence level with a 10,000-second counting time. While there does not appear to be a problem in application of beta spectrum analysis to other radionuclides such as the strontium-89 and -90, and yttrium-90 combination, analysis of nuclides other than tritium, carbon-14, and phosphorus-32 were not performed. Limitations on the number of beta-emitting radionuclides that can be present in a sample and the interference from gamma emitters present are discussed. (Diss. Abstr. Int., B)

9093 NONDESTRUCTIVE ASSAY MEASUREMENTS FOR IRRADIATED FUEL. Summary Report. Fleck, C. M. (Atominstitut der Oesterreichischen Hochschulen, Vienna); Ruppert, E.; Krinninger, H. Atomkernenergie; 23: No. 1, 169-175(1974). (In German).

A review of nondestructive burnup measurements is given. After a short discussion of the application in fuel management and nuclear safeguards, the well-established methods of flux and power distribution measurements are described. Then suggestions and experiments which will measure the burnups directly are discussed in three sections: in core methods, passive out-of-core methods and active out-of-core methods. (GE)

9094 TRITIUM IN FOODS. II. Scintillation Systems for the Measurement of Tritium in Samples of Water From Foods. Mlinko, S.; Fischer, E.; Diehl, J. F. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). Z. Anal. Chem.; 268: No. 2, 109-113(Jan 1974). (In German).

The qualities of selected scintillation systems for the measurement of very low tritium content in water samples from foods were investigated in the liquid scintillation spectrometer. The influence of the parameters of the measuring method on the detection limit was defined by figures of merit. Optimum values were obtained with an emulsion system, which consists of PPO, bis-MSB, p-xylene, and Triton N-101, and which takes up 40% water; 0.16 to 0.18 pCi/ml water are detectable with this system. Reference water, which is poor in tritium, was produced by combustion of propane. (GE)

9095 DETERMINATION OF RADIO-STRONTIUM IN THE DEVELOPMENT OF HIGH-TEMPERATURE REACTOR FUEL ELEMENTS IN THE KFA JUELICH. Methods and Results. Stoeppler, M.; May, K.; Zabel, W. (Kernforschungsanlage, Juelich, Ger.). (1973). vp. (In German).

From 24th IUPAC congress; Hamburg, Germany (2 Sep 1973).

A series of high-temperature irradiation experiments with spherical fuel elements for graphite-moderated, gas-cooled reactors has been performed to test, among other interesting parameters, the ability of the graphite shell to retain fission products under conditions of output operation. In this paper decomposition and separation method for the determination of a concentration profile of radiostrontium in the graphite shell is described which is suitable for routine analysis. The essential part of the method is the ion-exchange chromatographic separation of the strontium isotopes from other fission products with the aid of a combination of columns loaded mainly with potassium–hexacyanocobalt II–ferrate II and Dowex 1x8 in the hydroxide form with small amounts of sulfide. A radiochemical purity of about 95% ^{89}Sr and ^{90}Sr can be reached in the effluent, the radioactivity of which is measured by the Cherenkov effect in a liquid-scintillation counter. Some typical results are reported. (GE)

9096 ACTIVITY MEASUREMENT FOR THE DETERMINATION OF FRUIT JUICE CONTENT OF SYRUPS. Szabo, A.; Bende, E. (Megyei Elelmiszerellenorzo es Vegyvizsgalo Intezet, Gyor, Hungary). Izotoptechnika; 17: No. 4, 187-191(Apr 1974). (In Hungarian).

Radioactive isotopes in fruit syrups can be used for determination of juice content by measuring the activity of syrup and the juice ash. (auth)

9097 RAPID DETERMINATION OF PLUTONIUM IN URINE BY ULTRAFILTRATION. Stradling, G. N.; Popplewell, D.S.; Ham, G. J. (National Radiological Protection Board, Harwell, Eng.). Int. J. Appl. Radiat. Isotop.; 25: No. 5, 217-221(May 1974).

A rapid and inexpensive method for the determination of plutonium in urine has been developed. The principle depends on separating macromolecular plutonium species by ultrafiltration and directly counting the material retained on the membrane. Using a scintillation detection system having a background of 0.006 ± 0.002 cpm (2 S.D.) and a sample counting time of 8 hr, the limit of detection (background ± 2 standard deviations) was equivalent to 0.11 dpm in a 24-hr urine sample. The net α-activity of ultrafiltered material from the urine of humans unexposed to plutonium was 0.008 ± 0.008 cpm in a 24-hr sample. Because the reference level for plutonium, 0.44 dpm for a 24-hr sample, is exceeded only occasionally the method can be used without modification as an effective screening procedure. For the few samples of α-activity greater than the reference level a simple additional stage can be used to characterize the α-radiation. (auth)

9098 PROCEDURE FOR DIRECT MEASUREMENT OF LABELLED IMPURITIES IN BIG SOLID METAL SAMPLES. Holzhey, J. (Forschungszentrum fuer NE-Metalle, Freiberg i. B.). Isotopenpraxis; 9: No. 10, 367-369(Oct 1973). (In German).

A proposal was made to carry out the activity measurements for the determination of the amount of labelled impurities in

metals on large solid metal samples in an anticoincidence-large surface counter. The feasibility of the theoretical proposal was experimentally verified. Two examples are given of the practical utilization of this method for the measurement of inclusions in steel plates. (JSR)

9099 MASS SPECTROMETRIC ISOTOPE DILUTION ANALYSES OF CADMIUM IN STANDARD ROCKS. Rosman, K. J. R.; de Laeter, J. R. (Western Australian Inst. of Tech., South Bentley). Chem. Geol.; 13: No. 1, 69-74(Mar 1974).

Cadmium has been determined in a range of silicate rock standards using the stable isotope dilution technique incorporating solid source mass spectrometry. Recommended values are, in general, lower than the previously reported data. (auth)

9100 APPROXIMATE EMPIRICAL FORMULA FOR X-RAY INTENSITY IN RADIOACTIVE NUCLIDES. Okada, M. (Japan Atomic Energy Research Inst., Tokai). J. Radioanal. Chem.; 20: No. 1, 135-138(1974).

Known intensities of x-rays emitted from radioactive nuclides have been plotted against atomic number, and a distinct correlation has been found only for EC-decay type nuclides, as follows: $2.75\ Z^{1.06} > X > 0.507\ Z^{1.06}$, and $X_{\text{most probable}} = 1.18\ Z^{1.06}$, where X is the absolute percentage and Z is the atomic number of the decay product. (auth)

9101 CADMIUM-109 SOURCES FOR TRACE ANALYSIS BY X-RAY FLUORESCENCE. Shenberg, C.; Aladjem, A.; Amiel, S. (Soreq Nuclear Research Centre, Yavne, Israel). J. Radioanal. Chem.; 20: No. 1, 77-82(1974).

Procedures for preparing ^{109}Cd sources suitable for use in trace-element analysis by the x-ray fluorescence method were investigated. Sources were prepared from ^{109}Cd in a 0.1N HCl solution by three different techniques: (a) electrodeposition of ^{109}Cd onto a silver plate, which was then enclosed in a silver housing; (b) electrodeposition onto a lead foil, enclosed in a lead housing; (c) sorption of the ^{109}Cd on a Permutit anionic exchange membrane, which was then enclosed in a silver housing. Using identical test conditions, the best results were obtained with the last-mentioned source, which was used successfully for the determination of Br and Pb in organic materials at concentration levels of ppM. (auth)

9102 NONDESTRUCTIVE DETERMINATION OF NICKEL IN IRON METEORITES. Niewodniczanski, J.; Manecki, A.; Dominik, B. (Inst. of Nuclear Techniques, Krakow). J. Radioanal. Chem.; 20: No. 1, 71-75(1974).

Application of a portable radioisotope x-ray fluorescence analyzer for the determination of nickel in iron meteorites is described. The error of the XRF method was ±0.5% Ni at the 95% confidence level, which was confirmed by comparison with the results of other authors. In spite of limited accuracy this version of the radioisotope XRF method may find a wide application in meteorite studies, for rapid and nondestructive verification and classification of collected meteorite specimens. (auth)

9103 FAST RADIOCHEMICAL PROCEDURE FOR SEPARATING IODINE FROM FISSION PRODUCTS. Lavi, N. (Soreq Nuclear Research Centre, Yavne, Israel). J. Radioanal. Chem.; 20: No. 1, 41-49(1974).

The iodine isotopes produced by thermal neutron fission of ^{235}U were separated by a fast chemical procedure, with a separation yield of 95%. The gamma energies and relative intensities in the decay of ^{131}I, ^{132}I, ^{133}I, ^{134}I, and ^{135}I were determined using a Ge(Li) detector. (auth)

9104 INTERNAL NORMALIZATION TECHNIQUES FOR HIGH ACCURACY ISOTOPE DILUTION ANALYSES--APPLICATION TO MOLYBDENUM AND NICKEL IN STANDARD REFERENCE MATERIALS. Moore, L. J.; Machlan, L. A.; Shields, W. R.; Garner, E. L. (National Bureau of Standards, Washington, DC). Anal. Chem.; 46: No. 8, 1082-1089(Jul 1974).

General exact equations and iteration techniques were developed for internal normalization to eliminate the effect of thermal fractionation from isotope ratio measurements, and therefore isotope dilution analyses, by thermal ionization mass spectrometry. The techniques are applicable to more than 20 elements, and have been extensively applied to the determination of Mo in ore concentrates (55% Mo) and silicate trace standards (50 and 500 ppM Mo). The standard deviations of all internally corrected Mo isotope ratio measurements were <0.1%. The Mo sample size was 40 μg, but normalization techniques should apply to μg and smaller samples with a more sensitive ion detection system. Procedures are described for the chemical separation of Mo from matrix interferences and for the mass spectrometric analysis of Mo. Application of the techniques to Ni in three pollution Standard Reference Materials is described. (auth)

Separation Procedures

9105 (AERE-M-2629) DETERMINATION OF NITRIC ACID IN TRIBUTYL PHOSPHATE/KEROSENE PHASES CONTAINING URANIUM AND THORIUM. Wain, A. G. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Apr 1974. 7p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

Direct titration of nitric acid in organic phases containing uranium and thorium with an organic base is described and its application to process plant solutions suggested. (auth)

9106 (CEA-R-4523) CONCENTRATION OF GAS TRACES IN AIR BY DISTILLATION. Humbert-Droz, C.; Balard, F.; Leclerc, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). May 1974. 20p. (In French). Dep. NTIS (US Sales Only) $4.00.

A description of this installation, which enables gases to be distilled from volumes in excess of 400 liters, is given with the principles of operation. The installation was designed for concentrating traces of noble gases, hydrogen, and light hydrocarbons, its construction rendering it perfectly suitable for the concentration of stable and radioactive gas isotopes from air. (auth)

9107 (COO-1515-56) EXCHANGE OF LYOTROPIC SERIES CATIONS BY MICACEOUS VERMICULITE AND ITS WEATHERING PRODUCTS DETERMINED BY ELECTRON MICROSCOPY AND RADIOCHEMICAL ANALYSIS. Progress Report, August 1, 1971 - July 31, 1974. Jackson, M. L. (Wisconsin Univ., Madison (USA)). [nd]. Contract AT(11-1)-1515. 29p. Dep. NTIS $4.50.

The work is summarized under three topics. (1) Fission particle tracks of ^{238}U present in the octahedral sheet of micaceous vermiculite, after HF decoration, were photographed by scanning electron microscopy. Before HF treatment, diffusion of K^+, Fe, and $Si(OH)_4$ was enhanced by the presence of the tracks, and selective adsorption of fixing cations such as $^{137}Cs^+$ was increased. High resolution electron microscopy (HREM) revealed that the mixed-layer stacking sequence of most clays contain some micaceous vermiculite. Lateral variation along the (001) crystal planes was shown by blister morphology and also by HREM, thus demonstrating conclusively the existence of interlayer wedges active in selectivity of such cations as Cs^+. (2) Divalent cations of the $^{90}Sr^{2+}$ type and transition and heavy metal type are specifically sorbed by gel forms of hydrous oxides of Fe^{3+} and Al^{3+} which are almost universally present as coatings on soil particles. (3) Tropospheric dusts, shown to circulate world-wide and accrete in soils, deep-sea sediments, and island mountaintops from rainfall, show significant reactions with fission products such as $^{137}Cs^+$ and $^{90}Sr^{2+}$, variable according to dust composition. They influence the fate of radioisotopic fission products in air and soil. The findings are summarized with references to the specific publications in which they are reported. (auth)

9108 (IAEA-R-895-F) CHEMICAL BEHAVIOUR OF RADIONUCLIDES IN NATURAL WATERS AND THEIR INTERACTION WITH CHELATING AGENTS. Final Report, 15 March 1970 - 14 May 1973. Muzzarelli, R. (International Atomic Energy Agency, Vienna (Austria)). Jun 1973. vp. INIS.

Research involving the natural polymers, chitosan and chitin, is briefly summarized with reference to a new book, Muzzarelli, Natural Chelating Polymers, Pergamon Press Ltd., Oxford 1973, and two papers. Natural chelating polymers can be obtained from waste from marine product canning factories. A membrane having chelating properties was prepared from chitosan polymer solutions in formic acid and was characterized for gas permeability, chelating properties, electric conductivity, and structure. Chitosan was used as chromatographic packing for collection of various metals present in trace amounts of seawater and offers applications in determination of trace metal pollution; it may also have application for separation of trace radioactivity. (INIS)

9109 (JINR-P12-7928) THERMOCHROMATOGRAPHIC SEPARATION OF I, At, AND Hg: THE GASEOUS PRODUCTS OF NUCLEAR REACTIONS. Aikhler, B.; Domanov, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The separation of I, At, and Hg was carried out using the thermochromatographic column field with quartz powder coated with silver in air as a gas-stream. The adsorption temperature, FWHM of the peaks, and the effectiveness of separation were determined experimentally. The method described can be used for the separation of these elements in "on-line" regime on the beam of an accelerator. (auth)

9110 PRECIPITATION OF TITANIUM, ZIRCONIUM, AND THORIUM AND THEIR SEPARATION FROM IRON AND ALUMINUM WITH α-NAPHTHYLACETIC ACID. Konnov, V. A. (Inst.

of Oceanology, Moscow). Zh. Anal. Khim.; 29: No. 3, 476–479 (Mar 1974). (In Russian).

Titanium and zirconium are quantitatively precipitated by α-naphthylacetic acid from acid solution. The composition of titanium, zirconium, and thorium precipitates was determined for the precipitation conditions. The ammonium salt influences the discovery of titanium, zirconium, and thorium. The separation of titanium and zirconium from Fe(II) and Al is possible as well as thorium from Fe(II). (auth)

9111 USE OF N-CINNAMYLPHENYLHYDROXYLAMINE FOR SEPARATING TITANIUM AND ZIRCONIUM FROM MANGANESE, NICKEL, COBALT, AND ZINC. Ostroumov, E. A.; Kulumbegashvili, V. A. Tr. Inst. Okeanol., Akad. Nauk SSSR; 63: 194–198(1973). (In Russian).

From solutions of HCl and H_2SO_4 (1 N and higher) manganese, nickel, cobalt, and zinc are not precipitated by the above amine reagent. In the presence of these metals a study was made of the conditions of precipitating titanium and zirconium, and the amount of divalent metals absorbed by precipitates of titanium and zirconium was determined. A method was developed for separating Ti and Zr from Mn, Ni, Co and Zn. This method was used for chemical investigation of iron-manganese nodules recovered from the sea. (SJR)

9112 PRECIPITATION OF TITANIUM, ZIRCONIUM, AND THORIUM, AND SEPARATION OF THESE ELEMENTS FROM IRON AND ALUMINUM WITH DIPHENYLACETIC ACID. Konnov, V. A. Tr. Inst. Okeanol., Akad. Nauk SSSR; 63: 199–202(1973). (In Russian).

Diphenyl acetic acid (DPA) quantitatively precipitates titanium, zirconium and thorium from acid solution. The effect of ammonium salts on the separation of Ti, Zr and Th is made clear. It is possible to separate Ti and Zr from Fe and Al, if Fe(III) is reduced to Fe(II). Thorium can also be separated from divalent iron. This method can be used for chemical studies on iron-manganese nodules recovered from the sea. (SJR)

9113 PRECIPITATION OF TITANIUM, ZIRCONIUM, AND THORIUM, AND THE SEPARATION OF THESE ELEMENTS FROM MANGANESE, NICKEL, COBALT, AND ZINC BY MEANS OF AMMONIUM PHENYLACETATE. Volkov, I. I.; Konnov, V. A. Tr. Inst. Okeanol., Akad. Nauk SSSR; 63: 203–207(1973). (In Russian).

Ammonium phenylacetate with heating quantitatively precipitates Ti, Zr, and Th from a weak acid solution at a pH of 4.3–5.0. The precipitation can be carried out from a chloride, sulfate or nitrate solution. Large amounts of ammonium salts do not disturb the precipitation. The precipitate composition under the conditions of precipitation was determined. It is possible to separate Ti, Zr and Th from Mn, Ni, Co and Zn. The method can be used in analyzing Fe-Mn nodules from the sea. (SJR).

9114 PROCESS FOR SEPARATING CERIUM CONCENTRATE FROM ORES. Duncan, L. K. (to W. R. Grace and Co.). US Patent 3,812,233. 21 May 1974. Filed date 29 Dec 1965. 6p.

A process for separating cerium from the other rare earth values in bastnaesite ore by roasting the ore followed by leaching with dilute hydrochloride acid under carefully controlled conditions. (Official Gazette)

9115 SOLVENT EXTRACTION PROCEDURE FOR SEPARATING SAMARIUM FROM NEODYMIUM. Bauer, D. J.; Lindstrom, R. E.; Schultze, L. E. (to Secretary of the Interior). US Patent 3,812,232. 21 May 1974. Filed date 15 Aug 1972. 4p.

Separation of mixtures of metals, particularly complex lanthanide mixtures, in aqueous solution is accomplished by means of a process comprising total extraction of metal values into an organic extractant, and subsequent selective stripping of one or more of the metal values into an aqueous phase. (Official Gazette)

9116 ION EXCHANGE AND SOLVENT EXTRACTION. Marinsky, J. A.; Marcus, Y. (eds.). Series of Advances, Volume 3. New York; Marcel Dekker, Inc. (1973). 165p. $17.50.

Volumes 1 and 2 of this series were devoted to ion exchange. The third volume covering solvent extraction is divided into four sections: extraction of metals by carboxylic acids; solvent extraction with sulfonic acids; nuclear magnetic resonance studies of organophosphorus extractants; and experience with the AKUFVE solvent extraction equipment. (LK)

9117 EXTRACTION OF URANIUM(IV) FROM MIXED AQUEOUS–ORGANIC SOLUTIONS OF NITRIC ACID BY THE NITRATE OF THE SECONDARY AMINE AMBERLITE LA-1. Schmid, E. R.; Juenger, E.; Kenndler, E. (Univ., Vienna). Monatsh. Chem.; 104: No. 6, 1560–1569(Nov 1973). (In German).

The distribution of U(IV) between methanolic, ethanolic, and acetonic aqueous nitric acid solutions and the nitrate of the secondary amine Amberlite LA-1 in cyclohexane was investigated. The distribution of the excess acid and the alcohol (acetone) was also investigated. The U(IV) distribution data were correlated with (1) the content of nitric acid and U(IV)-hexanitratocomplex in the mixed aqueous-organic phase and (2) with the concentration of excess acid and methanol (acetone) in the organic phase. These correlations indicate that the extraction of U(IV) is mainly determined by (1) the shift of the complex equilibrium from the side of cationic species to that of neutral and anionic complexes and (2) the competition between these metal complexes and the acid as solvating partners for the extractant molecules. Spectrophotometric investigations show that in the organic phase uranium is present as a hexanitrato complex. (auth)

9118 APPLICATION OF HIGH-VOLTAGE ELECTROPHORESIS FOR THE SEPARATION OF RADIONUCLIDES. II. Separation of Short-Lived Uranium Fission Products. Buchtela, K. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Atomkernenergie; 22: No. 4, 268–271(1974). (In German).

Short-lived radionuclides are isolated from mixtures of fission products. Radioisotopes of cesium are separated and measured. Short-lived rare-earth nuclides are separated from neutron-irradiated uranium solutions; half-lives and gamma energies are measured for praseodymium 150 (30 ± 10 s, E_γ: 0.40, 0.90, 1.0 MeV) and neodymium 154 (40 ± 10 s, E_γ: 0.40, 0.70 MeV). (GE)

9119 SEPARATION OF RADIONUCLIDES BY HIGH-VOLTAGE ELECTROPHORESIS. III. Electrophoresis With Elution of Carrier Material. Buchtela, K. (Oesterreichische Hochschule, Vienna). Monatsh. Chem.; 104: No. 6, 1551–1559(Nov 1973). (In German).

A method of electrophoretic separation is described, which allows elution of the separated substances from the filter material during the electrophoresis. The apparatus can be used also for continuous separation of a mixture of two components. Examples are given for the separation of radioactive fission products and radioactive parent-daughter nuclides (strontium-90/yttrium-90 and neptunium-237/protactinium-233). (auth)

9120 COMPLEXING OF TRIVALENT ACTINIDE IONS BY THIOCYANATE. Kinard, W. F.; Choppin, G. R. (Florida State Univ., Tallahassee). J. Inorg. Nucl. Chem.; 36: No. 5, 1131–1134(May 1974).

The thermodynamic parameters for the formation of $M(SCN)^{+2}_{(aq)}$ (M = Eu, Am, Cm and Bk) have been obtained by the solvent extraction technique. The values are interpreted as indicating that $M(SCN)^{+2}_{(aq)}$ is predominantly outer sphere. Extraction over a wide range of thiocyanate concentration with DNNS, TBP and R_4NSCN extractants are interpreted as indicating that $M(SCN)_3$ is predominantly inner sphere. (auth)

9121 ELECTRODEPOSITION OF TELLURIUM FROM ALKALINE SOLUTIONS. Alekperov, A. I. J. Appl. Chem. USSR (Engl. Transl.); 46: No. 11, 2668–2670(Nov 1973).

Translated from Zh. Prikl. Khim.; 46: No. 11, 2519–2522(Nov 1973).

The dependence of the composition and properties of the electrolytic deposits on the composition of the electrolyte and the electrolysis conditions was studied. (UK)

9122 ION-EXCHANGE PROPERTIES OF TITANIC ANTIMONATE. Separation of Al^{3+} From Cr^{3+} and Fe^{3+}; Co^{2+} From Ni^{2+} and Mn^{2+}; UO_2^{2+} From Th^{4+}; and Zn^{2+} From Hg^{2+} and Cd^{2+}. Gill, J. S.; Tandon, S. N. (Univ. of Roorkee, India). J. Radioanal. Chem.; 20: No. 1, 5–15(1974).

Samples of titanic antimonate were prepared under varying conditions of precipitation, and their properties, compositions and ion-exchange behaviors and the effect of γ-radiation are reported. Some topical separations have been performed using this material. (auth)

9123 SEPARATION OF RADIONUCLIDES IN COLLOIDAL FORM FROM AQUEOUS SOLUTIONS. Kepak, F. (Inst. of Nuclear Research, Prague). J. Radioanal. Chem.; 20: No. 1, 159–166(1974).

A review is presented on the separation of colloidal radionuclides from aqueous solutions involving the sorption and flotation methods. (auth)

Inorganic, Organic, and Physical Chemistry

Refer also to abstracts 10909, 10920, and 12139.

Chemical and Physicochemical Properties

Refer also to abstracts 9696, 9699, 10035, 10142, and 10253–10255.

9124 (AERE-R-6566) SOLVATION IN LIQUID ALKALI METALS. Thompson, R. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Nov 1970. 30p. Dep. NTIS (US Sales Only) $4.50.

The solution of a crystalline solid in a liquid metal is discussed generally and a semi-empirical equation of the usual form log S (solubility) = A – (B/T) is derived from which the term A may be calculated directly for a given solute/solvent system. The energy term B is next considered and a solvation model developed for the solution of reacting non-metallic elements in liquid alkali metals. The model, based on the assumed presence of ionic solvating forces, predicts the solvation energies of the halides in alkali metal solvents and the calculated values agree well with those derived from experimental data. The model has been used to examine solutes other than the halides, namely oxygen, nitrogen, carbon and hydrogen, with the aim of suggesting the form in which they might exist in solution. (auth)

9125 (CEA-R-4520) INTRODUCTION OF LIQUID-VAPOR PHASE CHANGES INTO THE CHEMICAL EQUILIBRIA OF SILICA, ALUMINA, AND WATER AT HIGH TEMPERATURES. Humbert-Droz, C.; Dehais, R.; Frey, A. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 Montrouge (France)). May 1974. 16p. (In French). Dep. NTIS (US Sales Only) $4.00.

The changes at high temperature (3000 to 4000°K) in the number of molecules in the different phases of a mixture of silica, alumina, and water were studied using a chemical equilibrium system. The pressure conditions (1 to 500 bars) necessitated liquid gas phase changes and the taking into consideration of the variations in the concentration of each gas species as a function of its titer in the liquid. (auth)

9126 (NEL-563) BIBLIOGRAPHY OF THE THERMAL CONDUCTIVITY AND VISCOSITY OF CARBON DIOXIDE. Mackay, A. (National Engineering Lab., East Kilbride (UK)). Apr 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

A list of references to and a data survey of the transport properties of carbon dioxide is presented. The data survey gives the range of pressure and temperature over which the data exist together with the methods of measurement employed. (155 references) (auth)

9127 (NBS-TN-270-7) SELECTED VALUES OF CHEMICAL THERMODYNAMIC PROPERTIES. Tables for the Lanthanide (Rare Earth) Elements (Elements 62 Through 76 in the Standard Order of Arrangement). Schumm, R. H.; Wagman, D. D.; Bailey, S.; Evans, W. H.; Parker, V. B. (National Bureau of Standards, Washington, D. C. (USA)). Apr 1973. 102p. GPO $1.25.

Tables of values for the standard heats and Gibbs (free) energies of formation, entropies and enthalpies at 298.15°K and heats of formation at 0°K for compounds of the rare-earth elements (the lanthanides; lutetium through lanthanum; elements 62 through 76 in the Standard Order of Arrangement are presented. These tables are a continuation of the comprehensive revision of NBS Circular 500. (auth)

9128 (ORO-3018-130) PHYSICO-CHEMICAL STUDY OF SOME AREAS OF FUNDAMENTAL SIGNIFICANCE TO BIOPHYSICS. Final Report, 1971–1974. McGlynn, S. P. (Louisiana State Univ., Baton Rouge (USA)). 22 May 1974. Contract AT(40-1)-3018. 352p. Dep. NTIS $20.75.

Issued in two volumes, but cataloged as a unit.

The following areas of research are reported on: vacuum ultraviolet spectroscopy, polar molecules, photoelectron spectroscopy, effects of medium on luminescence, excited states of simple amides, excited states of α-dicarbonyls, electronic structure of simple inorganic substances, and geometry of excited molecules. (LK)

9129 ENERGETICS OF THE VALENCY TRANSITIONS OF SAMARIUM IN SOLID PHASES. Bayanov, A. P. (Kuban State Univ., Krasnodar, USSR). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 8, 1178-1179(Aug 1973).

Translated from Zh. Fiz. Khim.; 47: No. 8, 2093(Aug 1973).

The electronic phase transitions of samarium resulting from chemical interactions in solid phases are discussed in the light of the first and second laws of irreversible thermodynamics. The partial Gibbs free energy, enthalpy, and entropy of the transition of samarium from the tervalent to the bivalent state are calculated. Because of the low value of the transition energy (6.2 ± 1.7 kcal g-atom^{-1}), transitions in either direction can be induced by changes in external conditions. The thermodynamic characteristics of the monoselenides of a number of lanthanides are discussed. (auth)

9130 INVESTIGATION OF CHROMIUM OXIDE AND CHROMITE REDUCTION KINETICS. Samsonov, G. V.; Osipova, T. K. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 1-6(Apr 1974). (In Russian).

The kinetics of chromium oxide reduction by hydrogen, hard carbon, and combined method ($C + H_2$) without carbide additives and with the additive of 4 vol. % WC was studied. The combined method was established to be the best one; WC additives decrease the temperature of complete reduction by 100°C, and make its duration 1.5 times less. The effect was studied of WC additive as applied to the reductive process of chromites containing 1-15% C. (auth)

9131 INFRARED SPECTROMETRIC STUDY OF THE ASSOCIATION OF FOUR PROTON ACCEPTORS WITH FIVE NITROGENATED HETEROCYCLES BELONGING TO A SERIES OF CHEMICAL RADIOPROTECTING SUBSTANCES. Mariaggi, N. (Univ., Grenoble, France); Rinaldi, R.; Cornu, A. (Univ., Grenoble, France). Ann. Phys. Biol. Med.; 7: No. 2, 51-61(Apr 1973). (In French).

In order to gain a better understanding of the mechanisms responsible for the radioprotective properties of some nitrogenated heterocycles, the common properties of such compounds (the formation of hydrogen bonds) were studied. The thermodynamic characteristics of reactions corresponding to associations formed by the hydrogen bonding of these five proton donors with four acceptors were determined using infrared spectrometry intensity measurements of the vibration band attributed to the NH group. An attempt was then made to discover whether a linear relation exists between the energy due to the NH–O association alone and the reduction in the frequency of the NH vibrator. (FR)

9132 EFFECT OF X RAYS ON THE RNA METABOLISM IN EHRLICH ASCITES TUMOR CELLS. Kirschbaum, E. Hamburg; Univ. Hamburg (1972). vp. (In German).

Thesis.

The metabolism of RNA in irradiated Ehrlich ascites tumor cells was studied in vitro. It was found that the total RNA synthesis is mammalian cells is hardly affected by irradiation. In further experiments cell nuclei were prepared and two RNA fractions with different base composition were isolated according to the method of Georgiev and Mantieva (thermic fractionation). The H^3-uridine incorporation into the 65°C fraction decreased in the dose range of 1,000 to 1,500 R, whereas the 50°C fraction showed no marked changes in RNA synthesis. Experiments on the effect of irradiation on newly synthesized RNA (chase-experiments) produced no observable degradation of RNA under our experimental conditions. (auth)

9133 ELECTROTRANSPORT OF ^{22}Na AND OF ^{195}Au IN LIQUID SODIUM. Persson, T.; Lodding, A. (Chalmers Tekniska Hoegskola, Goteborg). Z. Naturforsch., 28a: No. 12, 1971-1972(Dec 1973).

The mobilities of radioactive Na and Au tracers under electric current in liquid Na have been studied. In both cases the tracer is enriched at the anode, but the mobility of the impurity is by about two orders of magnitude greater than that of the Na tracer. The Haeffner-effect, for the first time studied with a radioactive isotope, yielded an "isotope factor" $x \approx 0.2$ at 180°C. (GE)

9134 DIFFUSION IN THE SYSTEM WATER/TRI-N-BUTYL PHOSPHATE. Effect of Aqueous Electrolytes, and of Organic Phase Water Concentration. Hipfner, J. C.; Tuck, D. G. (Univ. of Windsor, Ont.). J. Chem. Soc., Faraday Trans., I; 70: No. 3, 528-534(1974).

The interfacial permeability coefficient k for the transfer of water across the water/tri-n-butyl phosphate (TBP) interface has been determined as a function both of aqueous electrolyte concentration, and of the initial water concentration in the TBP. The diffusion coefficient D of water in the organic phase has also been measured. Both k and D are found to be independent of electrolyte concentration over the range 0 to 1 mol dm^{-3} aqueous NaCl, and for 1.25 mol dm^{-3} aqueous $Cr(NO_3)_3$. The coefficient D is dependent on the initial water concentration in the TBP phase, with a maximum value at a TBP/H_2O mole ratio ≈ 2. Determination of D in TBP saturated with water where no interfacial movement is possible was based on an ^{18}O tracer method. The results are discussed in terms of possible diffusion mechanisms. (auth)

9135 SOLUTIONS OF HYDROGEN AND OXYGEN IN LIQUID SODIUM. Pulham, R. J.; Simm, P. A. (Univ. of Nottingham, England). pp 317-332 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York;

Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

An apparatus is described for studying the reaction of gases with a jet of liquid sodium at high temperatures. The reaction of hydrogen and water vapor with sodium at 370, 400, and 430°C is followed by pressure measurements. The reaction of hydrogen with solutions of oxygen in the metal at 400°C is also described. The rates of solution and equilibrium pressures of hydrogen are discussed on the basis of an equilibrium in solution between hydride, oxide, and hydroxide ions. (6 fig.) (auth)

9136 HYDROGEN–OXYGEN INTERACTIONS IN LIQUID SODIUM. Minushkin, B.; Kissel, G. (Brookhaven National Lab., Upton, NY). pp 333-349 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

The reaction between O and H in sodium at 500°C was studied using the H partial pressure and O activity. O concentrations from <50 to 500 ppM and H partial pressures from <1 to 40 torr were used. Results showed a definite interaction between O and H in the sodium. For a system containing a fixed quantity of H, the H pressure decreased as the O activity increased and vice versa. The addition of H to sodium that contained a fixed amount of O lowered the measured O activity. Assuming the interaction between O and H results in formation of a "hydroxide solution compound" according to the reaction $NaOH(d) + Na(l) \rightleftharpoons Na_2O(d) + \frac{1}{2} H_2(g)$, an equilibrium constant of 0.2 or 0.6 $atm^{\frac{1}{2}}$ was obtained. The uncertainty arises from uncertainties in the solubility of O in sodium. However, the experimental values compare favorably with equilibrium constants calculated from thermochemical data. Results indicate that H does affect the calibration of the electrochemical O meter. However, at the low H partial pressures encountered in typical systems, the effect should be negligible. (6 fig.) (auth)

9137 HYDROGEN BEHAVIOR AT LOW CONCENTRATIONS IN LIQUID SODIUM. Katsuta, H.; Furukawa, K. (Japan Atomic Energy Research Inst., Tokai). pp 351-363 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

The hydrogen behavior in the sodium test loop similar to the sodium-cooled FBRs was examined measuring hydrogen equilibrium pressure by a membrane-permeation type hydrogen meter in 600 to 700°C flowing sodium of impurity levels controlled by a cold trap at 115 to 208°C. Measured hydrogen pressures are in a good agreement with the dissociation pressure of sodium hydride in the cold trap when the minimum temperature is higher than 180°C. However, at lower temperatures the hydrogen pressure is unexpectedly high. In this region the hydrogen concentration is less than 1 ppM, and the hydrogen behavior is influenced by other impurities, especially oxygen. (auth)

9138 THERMOMAGNETIC ANALYSIS AND CALORIMETER STUDIES OF THE REACTIONS OF FERRIC OXIDE WITH LIQUID SODIUM. Charles, R. G.; Biggs, P. H. (Westinghouse Research Lab., Pittsburgh). pp 381-401 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

The reactions of α-Fe_2O_3 with liquid sodium were studied by means of thermomagnetic analysis and differential scanning calorimetry. Reaction products which were identified are Fe_3O_4, γ-Fe_2O_3, iron metal, and a double oxide of probable formula $(Na_2O)_2FeO$. Which of these products are formed, and their relative proportions, are markedly dependent on the temperature of reaction and, also, on the initial ratio of reactants Na/α-Fe_2O_3. Under the proper experimental conditions, the double oxide $(Na_2O)_2FeO$ can be formed and decomposed reversibly, by cycling the temperature between prescribed limits. (9 fig.) (auth)

9139 NOVYE METODY ISSLEDOVANIYA PROTSESSOV VOSSTANOVLENIYA TSVETNYKH METALLOV. (New Methods for the Investigation of Reduction Processes in Non-Ferrous Metals. Proceedings of the Symposium on Experimental Methods for the Study of Processes and Physico-Technical Characteristics of the Reduction of Ferrous and Non-Ferrous Metals, Moscow, USSR, November 1–5, 1971). Chizhikov, D. M. (Ed.). Moscow; Izdatel'stvo Nauka (1973). 180p. (CONF-711158-).

Forty-one papers are included. Separate abstracts were prepared for five of the papers. (DLC)

For abstracts of individual papers see: 10253–10256 and 10313.

9140 SYNTHESIS OF SODIUM HYDROXYTRIFLUOROBORATE. Gilpatrick, L. O. (to United States Atomic Energy Commission). US Patent 3,809,762. 7 May 1974. Filed date 18 Aug 1972. 4p.

Sodium hydroxytrifluoroborate is synthesized by reacting bicarbonate of soda with boron trifluoride. This compound is used to sorb (basically by ion exchange) the tritium formed by (n,α) reactions on ^{6}Li and ^{7}Li in the operation of a molten salt breeder reactor. (LK)

Isotope Effects

9141 STEREOCHEMISTRY OF THE SOLVOLYSIS OF MENTHYL TOSYLATE. Example of Retained Chair Conformation in the Transition State. Hirsl-Stacevic, S.; Majerski, Z.; Sunko, D. E. (Indiana Univ., Bloomington). J. Amer. Chem. Soc.; 96: No. 11, 3659-3661(29 May 1974).

The solvolysis of menthyl tosylate in both aqueous ethanol and aqueous trifluoroethanol gives hydroxylic substitution products of predominantly retained configuration (58% in ethanol, 83% in trifluoroethanol). This result and the observed significantly reduced β,β'-d_2 isotope effect ($k_H/k_D = 1.30$), which contradict the expected behavior of most cyclohexyl derivatives, suggest a retained chair conformation in the rate-determining transition state and the intermediate ion pair(s). (LK)

9142 IR SPECTRA OF BF_3 COMPLEX COMPOUNDS AND CALCULATION OF THE EQUILIBRIUM CONSTANTS OF CHEMICAL ISOTOPIC EXCHANGE REACTIONS. Part I. Calculation of the Partition Functions of Isotopic Species of Some Boron-Containing Molecules. Voloshchuk, A. M.; Katal'nikov, A. M.; Knyazev, D. A. (Moscow Physical-Technical Inst.). Kernenergie; 17: No. 1, 20-23(Jan 1974). (In Russian).

Drawing on the literature data, the partition functions (β factors) were calculated for the isotopic species of boron halides of BX_3, BX_2Y, BXY_2, BX_4^-, and BX_3Y^- type, of boric acid, trimethylborine, trimethoxyboron, $HBCl_2$, $DBCl_2$, B_2H_6, and of the ions $B(OH)_4^-$, BO_2^-, BH_4^-, and BD_4^-. If experimental values of the frequencies of the isotopic species of the molecules were not available, they have been calculated by means of the Urey-Bradley-Shimanouchi force field, by the comparison method, or by the addition scheme. The calculations may form the theoretical basis for applying some chemical exchange systems to separation of boron isotopes. (auth)

9143 ORIENTATION BEHAVIOR OF ADSORBED PYRIDINE AND PYRAZINE AT THE MERCURY-WATER INTERFACE IN RELATION TO SOLUTION THERMODYNAMIC PROPERTIES. Conway, B. E.; Mathieson, J. G.; Dhar, H. P. (Univ. of Ottawa). J. Phys. Chem.; 78: No. 12, 1226-1234(6 Jun 1974).

An experimental procedure for evaluation of the orientation of solvent molecules at the Hg–H_2O interface is described, based on the study of adsorption of pyrazine and pyridine. The adsorption and orientation behavior is investigated in relation to the solution properties of these two molecules, characterized by partial molal volume and compressibility measurements in H_2O and D_2O. The free energies of adsorption are substantially coverage dependent, even in the case of pyrazine, which, overall, is a nonpolar molecule. This behavior is discussed in terms of intermolecular H bonding with water in the interphase. The orientation effects are indicated by evaluation of surface dipole potential changes caused by displacement of oriented solvent by the organic adsorbate. The orientation effects are examined in relation to the surface pressure behavior at the Hg electrode–water interface. In the case of pyridine and pyrazine, the charge dependence of water orientation at the Hg electrode can be quantitatively evaluated while, with pyridine, the extent of orientation of the organic molecule itself can be calculated in terms of its own surface dipole potential contribution. (auth)

9144 CHEMISTRY OF ALKYL THIOLSULFINATE ESTERS. VI. Preparation and Spectral Studies. Block, E.; O'Connor, J. (Univ. of Missouri, St. Louis). J. Amer. Chem. Soc.; 96: No. 12, 3921-3929(12 Jun 1974).

Full details are given of the synthesis, properties, and certain reactions of a variety of dialkyl thiolsulfinate esters. The S–S bond energy in MeS(O)SMe has been determined by appearance potential methods to be 46 kcal/mol, compared to a corresponding value of ~75 kcal/mol in MeSSMe. A reinvestigation of the peracid

oxidation of 2-methyl-2-propyl ethyl disulfide has shown that the oxidation does not afford 2-methyl-2-propyl ethanethiolsulfinate (t-BuSS(O)Et) as the only product, as originally claimed, but rather gives a mixture of this product and ethyl 2-methyl-2-propanethiolsulfinate (t-BuS(O)SEt), with the latter compound predominating by a ratio of ~2:1. Synthetic approaches and spectral data are given for a variety of new, specifically deuterated mercaptans, disulfides, thiolsulfinates, and thiolsulfonates as well as nondeuterated thiolsulfinates and thiolsulfonates. The disproportionation of several unsymmetrically deuterated dialkyl thiolsulfinates has been studied using gc-ms techniques and it is concluded that unsymmetrical thiolsulfonate predominates over symmetrical thiolsulfonate. Electron-impact-induced processes of unsymmetrical dialkyl thiolsulfinates are described and contrasted with thermal processes. Contrary to the conclusions of a published study of the mass spectra of diaryl thiolsulfinates, it is concluded that disulfide formation is better explained in terms of a thermal rather than electron impact induced process. A unique feature of the fragmentation of EtS(O)SEt is the formation of H_2S_2O, corresponding to the unknown parent acid of thiolsulfinate esters. Other aspects of the fragmentation of dialkyl thiolsulfinates have been studied with deuterium labeling and metastable defocusing methods; these studies provide evidence for nonspecific hydrogen transfer processes. (auth)

9145 CHLORINE KINETIC ISOTOPE EFFECT MODELS. II. Vibrational Analysis and KIE Calculations of Tert-Butyl Chloride Transition State Models. Williams, R. C.; Taylor, J. W. (Univ. of Wisconsin, Madison). J. Amer. Chem. Soc.; 96: No. 12, 3721-3727(12 Jun 1974).

A transition state model is advanced for the methanol solvolysis of tert-butyl chloride, and various transition state structures are evaluated in terms of their calculated chlorine kinetic isotope effects. The best model gives chlorine KIE values of 1.01087 and 1.00951 at 10 and 60°, respectively, vs. the experimentally determined values of 1.0108_7 and 1.0095_3, and does not require large imaginary values of $\nu_{\perp}$. The influence of transition state geometry on calculated KIE is appreciable; there is a good correlation between the transition state carbon-chlorine bond length and the difference in KIE values at 10 and 60°. The degree of planarity of the $C(CH_3)_3$ group correlates well with the temperature-independent factor $\nu_{\perp 1}/\nu_{\perp 1}$, as does the carbon-methyl group bond length. The most probable transition state configuration in the methanol solvolysis of tert-butyl chloride is estimated to be C–Cl = 1.89 Å, $C-CH_3$ = 1.50 Å, and $Z(CH_3)$ = –0.16 Å, relative to the central carbon. The effects of various transition state force constant assumptions are studied, and methods of estimating transition state force constants are enumerated. (auth)

9146 SOLVENT ISOTOPE EFFECTS IN THE CLEAVAGE OF BENZYLTRIMETHYLSILANES AND -STANNANES BY ALKALI. Alexander, R.; Asomaning, W. A.; Eaborn, C.; Jenkins, I. D.; Walton, D. R. M. (Univ. of Sussex, Eng.). J. Chem. Soc., Perkin Trans., II; No. 5, 490-494(1974).

Product isotope effects, given by the product ratio $XC_6H_4 \cdot CH_2/XC_6H_4 \cdot CH_2D$, have been measured for cleavage at ca. 21°C of some compounds of the type $XC_6H_4 \cdot CH_2 \cdot MMe_3$(M = Sn or Si) in 1:1 MeOH-MeOD containing sodium methoxide (2 mol l^{-1}). Values for various substituents X and M = Sn are: p-Me, 2.4; H, 2.1; p-Cl, 2.1; m-CF_3, 2.1 (all ± 0.15); and for M = Sn: H, 1.17; m-OMe, 1.25; p-Cl, 1.07; m-CF_3, 1.19 (all ± 0.05). The corresponding value for $C_6F_5 \cdot CH_2 \cdot SiMe_3$ is 1.16. Overall solvent isotope effects $(k_{SH}/k_{SD})_t$ given by the individual rates in non-deuterated and deuterated media at 50°C have been determined for the compounds with X = m-CF_3. The values are: for M = Si, 0.50 in MeOH or in MeOH containing 18.6 mole % H_2O: for M = Sn, 0.95 in MeOH and 0.97 in MeOH containing 20 mole % H_2O. It is concluded that, in the cleavage of the tin compounds certainly, and probably also in that of the silicon compounds, a free carbanion is not formed. It is suggested that the rate-determining step involves proton transfer from the solvent to the carbon atom of the breaking $M-CH_2 \cdot C_6H_4 \cdot X$ bond, with the MeO–M bond fully or almost fully formed in the transition state. Initial formation of the M^V intermediates $[(MeO)\ Me_3M \cdot CH_2 \cdot C_6H_4X]^-$ is favored. (auth)

9147 ISOTOPE EFFECTS IN THE REDUCTIVE DEMERCURATION OF HEX-5-ENYL-1-MERCURIC BROMIDE BY $NaBH_4$ AND $LiAlH_4$. Quirk, R. P.; Lea, R. E. (Univ. of Arkansas, Fayetteville). Tetrahedron Lett.; No. 22, 1925-1928(May 1974).

Extensive studies established the intermediacy of alkyl radicals in the reductive demercuration of alkylmercuric halides by sodium borohydride. Mechanisms involving hydrogen atom transfer from an alkylmercuric hydride to alkyl radicals were proposed for these reductions using a variety of metal hydrides. Novel isotope effect studies of the reductive demercuration of hex-5-enyl-1-mercuric bromide by $NaBH_4$ ($NaBD_4$) and $LiAlH_4$($LiAlD_4$), which characterize the intermediates involved in these reactions and quantitatively account for the isotopic compositions of the products are reported. (UK)

9148 DEUTERIUM ISOTOPE EFFECTS ON ACYLATION OF SUBTILISIN. Polgar, L. (Inst. of Biochemistry, Budapest). Biochim. Biophys. Acta; 321: No. 2, 639-642(10 Oct 1973).

^2H_2O effects on the hydrolyses of nonactivated alkyl and the corresponding activated alkyl thiol and p-nitrophenyl esters by subtilisin, Type Carlsberg, were investigated. Similar effects were obtained with the activated and nonactivated esters of acetic and cinnamic acids. This rules out the formation of a transient acyl-imidazole intermediate in the catalysis by serine proteases proposed by Hubbard, C. D. and Kirsch, J. F. (1972) Biochemistry 11, 2483-2493, for nonspecific-activated ester substrates. Stereochemical considerations based on model building of the active site of subtilisin offer further evidence against nucleophilic catalysis by the histidine residue. (INIS)

9149 WAYS OF USING THE TRITIUM KINETIC ISOTOPIC EFFECT TO STUDY THE MECHANISM OF DEHYDROGENATION OF HYDROCARBONS. Isagulyants, G. V.; Klimov, A. P.; Khairudinov, I. R.; Derbentsev, Yu. I. (Inst. of Organic Chemistry, Moscow). Kinet. Catal. (USSR) (Engl. Transl.); 14: No. 5, 1150-1154(1973).

Translated from Kinet. Katal.; 14: No. 5, 1309-1314(1973).

The connection between kinetic isotope effects of the forward and reverse reactions and the thermodynamic isotope effect for the case of using a radioactive isotope as an indicator was studied. For reactions occurring with cleavage of several equivalent hydrogen atoms a method was proposed of using tritium to determine the number n of atoms, cleaved in the limiting step. Use of the method in dehydrogenation of cyclohexane on a series of catalysts led to various values of n for metallic (on supports) and oxide catalysts. (auth)

9150 ISOTOPE EFFECT IN THE CONSOLUTE TEMPERATURES FOR A NUMBER OF SUBSTANCES IN DEUTERIUM OXIDE AND DEUTERIOETHYLENE GLYCOL. Tsvetkov, V. G.; Rabinovich, I. B. Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 9, 1355-1357(Sep 1973).

Translated from Zh. Fiz. Khim.; 47: No. 9, 2403-2404(Sep 1973).

The isotope effects in the miscibility and the consolute temperatures for heavy water and deuterioethylene glycol with certain organic substances were determined. The dependence of the isotope effect on the absolute consolute temperature has been examined. A negative isotope effect in the consolute temperature is characteristic of heavy water above 220°C [$t_{cr}(D) < t_{cr}(H)$]. (auth)

9151 ACID-INDUCED REACTION OF ARYLDIAZOMETHANES WITH OLEFINS. Mechanism of Reaction. Closs, G. L.; Goh, S. H. (Univ. of Chicago). J. Org. Chem.; 39: No. 12, 1717-1723 (14 Jun 1974).

The acid-induced reaction of aryldiazomethanes with olefins gives arylcyclopropanes in addition to olefins and esters. The cyclopropane products are formed stereospecifically and their yields are largest in reactions with olefins which on cation addition give secondary carbonium ion centers. Stereoisomeric mixtures of 3-methyl-4-aryl-2-butyl derivatives from reactions in cis- and trans-butene were found to arise probably by a preferential cis mode of addition. The use of deuterated acids leads to partial incorporation of deuterium in the cyclopropane adducts while the use of phenyldiazomethane-α-d_1 leads to partial loss of deuterium. The extent of deuterium incorporation is dependent on the strength of the acid used as well as the basicity of the aryldiazomethanes. A carbenoid mechanism of the reaction is proposed. (auth)

9152 KINETICS OF OXIDATION OF ALDO SUGARS BY Ce(IV) IN AQUEOUS SULFURIC ACID. Mehrotra, R. N.; Amis, E. S. (Univ. of Jodhpur, India). J. Org. Chem.; 39: No. 12, 1788-1791(14 Jun 1974).

Possible steps in the mechanism of the oxidation of aldo sugars by Ce(IV) at 25° are presented. In a comparison of the rates of oxidation and mutarotation, it is concluded that the rate of transformation of α-glucose into β-glucose is many times greater than the rate of glucose oxidation with respect to glucose. The retardation of the reaction rate in deuterium oxide is not due to mutarotation. The magnitude of the solvent isotope effect, k_{H_2O}/k_{D_2O} = 1.5 and 1.9 for glucose and galatose, respectively, indicates that the O–H bond is being affected in the rate-limiting step, and consequently substantiates to some degree the assumption of O–H fission made in previous studies. (JGB)

9153 RAMAN SPECTRA AND STRUCTURE OF WATER FROM –10 TO 90°. Scherer, J. R.; Go, M. K.; Kint, S. (Agriculture Re-

search Service, Berkeley, CA). J. Phys. Chem.; 78: No. 13, 1304-1313(20 Jun 1974).

Raman spectra were obtained for liquid H_2O and D_2O from −10 to 90°C and for HOD from 10 to 90°C. Quantitative intensities were measured for H_2O and D_2O and the intensity sum rule is found to hold to within 10%. The difference between the depolarization ratios of the OH and OD stretches of HOD is explained on the basis of approximate normal coordinates and bond polarizability theory. The occurrence of apparent isosbestic points in observed Raman data that has not been decomposed into its isotropic and anisotropic parts is shown to be fortuitous. The isotropic and anisotropic spectra of the OH and OD stretching regions of H_2O and D_2O are interpreted in terms of four bands. These bands are attributed to the symmetric and antisymmetric OH and OD stretching vibrations of a symmetrically hydrogen-bonded complex and the stretching vibrations of an asymmetrically hydrogen-bonded complex. Fermi resonance is shown to be responsible for the dip in the spectrum at the position of the first overtone of the HOH and DOD bending vibrations. The band-fitting procedure is constrained by assumptions involving half-widths, band centers, and intensity arguments. The resulting analysis associates the intensity increase with decreasing temperature at 3430 cm^{-1} (2530 cm^{-1} for D_2O) in the anisotropic spectrum with the antisymmetric OH stretching vibrations of the symmetric hydrogen-bonded complex. (auth)

9154 EXCITED STATES. Volume 1. Lim, E. C. (ed.). New York; Academic Press, Inc. (1974). 356p. $12.75.

The following topics are discussed: molecular electronic radiationless transitions; double resonance techniques and the relaxation mechanisms involving the lowest triplet state of aromatic compounds; optical spectra in molecular solids; dipole moments and polarizabilities of molecules in excited electronic states; luminescence characteristics of polar aromatic molecules; and interstate interaction in aromatic aldehydes and ketones. (LK)

9155 KINETICS OF THE EQUILIBRIUM CIS- REVERSIBLE TRANS-DIAQUOBIS(OXALATO)CHROMATE(III). II. Acid-Catalysed Reactions In H_2O and In D_2O. Rophael, M. W.; Malati, M. A. (National Research Centre, Cairo). J. Inorg. Nucl. Chem.; 36: No. 6, 1355-1358(Jun 1974).

The acid catalysis in the equilibrium: cis- $\rightleftharpoons$ trans-$[Cr(C_2O_4)_2(H_2O)_2]^-$ has been studied starting with solutions of each isomer. The rate constant may be expressed by: $k_r = (k_1 + k_{-1}) + (k' + k'')[H^+]$, where the constants k_1 and k_{-1} refer to the acid-independent forward and backward reactions, respectively, and the constants k' and k'' refer to the corresponding acid-catalyzed reactions. A fast equilibrium between each complex ion and H^+_{aq} is assumed, followed by isomerization. The activation parameters indicate that the catalytic effect is an entropy effect. The mechanism suggested is in agreement with the isotope effect, calculated from the ratio of the rate constants in D_2O and in H_2O. (auth)

Isotope Exchange and Isotope Separation

Refer also to abstracts 9055 and 9211.

9156 EXCHANGE OF OXYGEN-18 BETWEEN AQUOPENTAAMMINEIRIDIUM(III) ION AND SOLVENT WATER. Pressure Effect and Mechanism. Tong, S. B.; Swaddle, T. W. (Univ. of Calgary, Alberta). Inorg. Chem.; 13: No. 6, 1538-1539(Jun 1974).

This study was made to seek support for the associative interchange mechanism assigned by E. Borghi, F. Monacelli, and T. Prosperi [Inorg. Nucl. Chem. Lett. 6, 667(1970)].

9157 NO–HNO_3 EXCHANGE SYSTEM FOR PRODUCTION OF ^{14}N HIGHLY DEPLETED OF ^{15}N. Ghate, M. R.; Taylor, T. I. (Columbia Univ., New York). Separ. Sci.; 9: No. 2, 147-165(1974).

The isotopic exchange reaction between NO and HNO_3 was used to prepare ^{14}N highly depleted in ^{15}N. This required an efficient reflux system of low holdup to convert oxides of nitrogen to nitric acid by reaction with oxygen and water. A study of the characteristics of the one constructed showed that less than 1 part in 32,000 of the nitric acid was lost from the refluxer as oxides of nitrogen. ^{14}N with an atom fraction of less than 0.00004 of ^{15}N was prepared at the rate of 46.0 g/day. The application of the refluxer to a system for producting ^{15}N is discussed. (auth)

9158 ISOTOPIC EXCHANGE REACTIONS IN LIQUID SULFUR DIOXIDE. 7. Catalysis by Antimony Pentafluoride of Sulfur Exchange Between Thionyl Fluoride and Sulfur Dioxide. DeGroot, P. B.; Norris, T. H. (Oregon State Univ., Corvallis). J. Inorg. Nucl. Chem.; 36: No. 5, 1123-1129(May 1974).

Radiosulfur (^{35}S) exchange has been studied in liquid mixtures of thionyl fluoride and sulfur dioxide. While no exchange occurs between the two species alone, the addition of antimony pentafluoride leads to exchange, both observations being parallel to those observed with the analogous chlorine compounds. The kinetics of the exchange has been interpreted in terms of equilibria involving 1:1 adducts between catalyst and each solvent species as well as a polymeric antimony pentafluoride species. The rate-determining step consists of bimolecular interaction between either 1:1 adduct and the other solvent species. For the reaction between $SO_2 \cdot SbF_5$ and SOF_2 the rate constant is $k = 1.85 \times 10^7 \exp(-17{,}300/RT)$ l.mole^{-1} sec^{-1}, $\Delta S^{\neq} = -27.3 \pm 3.9$ e.u. (auth)

9159 MECHANISM OF MULTIPLE H–D EXCHANGE IN HOMOGENEOUS ACTIVATION OF SATURATED HYDROCARBONS. Rudakov, E. S.; Shteinman, A. A. (Inst. of Catalysis, Novosibirsk, USSR). Kinet. Catal. (USSR) (Engl. Transl.); 14: No. 5, 1192-1194(1973).

Translated from Kinet. Katal.; 14: No. 5, 1346-1348(1973).

Using the method of steady concentrations, formulas were derived for calculating the distribution of deutero products in K_2PtCl_4-catalyzed homogeneous exchange of saturated hydrocarbons with D_2O. The close agreement of the experimental and theoretical values for methane and ethane shows that the postulated mechanism of homogeneous multiple exchange is correct, and that it is the same as the mechanism of heterogeneous exchange of RH with D_2. (auth)

Feed Materials Processing

9160 PRELIMINARY DRAFT FOR THE ELECTRICAL INSTALLATION OF A BENEFICIATION PLANT FOR URANIUM ORES. Rios Uribe, J. R. Mexico City; Instituto Politecnico Nacional (1973). 191p. (In Spanish).

Thesis.

An ore processing plant is being designed for the processing of El Nopal ores, primarily a mixture of uranophane and β-uranophane. The processing procedure can be divided into 6 steps: receiving and crushing, wet grinding, leaching, washing of the leached pulp, solvent extraction, and precipitation. The design of the low-voltage system for each of these steps is described in detail. The design of the electrical substation is outlined. The protection systems needed to ensure operation of the electrical installations are discussed. A cost analysis is made of the system proposed. (JSR)

9161 PROCESSES FOR RECOVERING URANIUM VALUES FROM ORES. Smith, S. E.; Lapage, R.; Garrett, K. H. (to United Kingdom Atomic Energy Authority). US Patent 3,808,306. 30 Apr 1974. Priority date 21 May 1970, United Kingdom of Great Britain and Northern Ireland. 10p.

The present process provides an alternative to the dilute-acid process for recovering uranium values from refractory ores. Instead of fine-grinding the ore, it is comminuted to a relatively large top size (not substantially smaller than 1 mm) and mixed with sufficient sulfuric acid of relatively strong concentration, suitably about 6 N, to wet the ore without forming a continuous liquid phase. Optionally, a curing agent may be added. The mixture is cured at an elevated temperature, up to about 100°C, for a relatively short time as compared with the dilute-acid process, and the uranium then eluted from the mixture by contacting with water. Provided the mixing results in adequate granulation, the elution can be effected by simple percolation through the cured ore bed. (Official Gazette)

Radiation Chemistry

Refer also to abstracts 9122, 9212, 9218, 9659, 9708, 9723, 9789, 9939, 11446, and 11578.

9162 (BMVg-FBWT-72-6) RADIATION DAMAGE IN ORGANIC ESPECIALLY BIOLOGIC PREPARATIONS AND POLYMERS. Investigation by Means of Paramagnetic Resonance and Nuclear Magnetic Resonance by Detecting and Identifying the Radicals Formed. Langendorff, H.; Moenig, H. (Bundesministerium fuer Verteidigung, Bonn (F. R. Germany). Dokumentationszentrum der Bundeswehr; Freiburg Univ. (F. R. Germany). Radiologisches Inst.). 1972. 60p. (In German). INIS.

By means of ESR spectroscopy, the radiation-induced formation of free radicals in sulfur-containing low-molecular and macro-molecular substances has been investigated, as some of these have been found to decrease the radiosensitivity of animals. The following substances have been examined: cysteamine, cysteine, isocysteine, homocysteine, polyvinylmercaptan, methionine, ethionine, S-alkylated cysteine, pyridoxine, and some mercapto derivatives of pyridoxine, as well as proteins (bovine serum albumin, trypsin). X-ray or gamma-irradiation at room temperature induces predominantly sulfur radicals of the RS-type. The type of bonding of the divalent sulfur plays an im-

portant part in the formation of sulfur radicals. Radical transfer has been observed in compounds containing sulfur and alkyl radicals, with the amount of S-radicals increasing in the process. This mechanism depends both on the environment and the molecular structure. Significant differences have been detected by quantitative measurements of the radical concentrations even in very similar homologous compounds. (The G-value of the radical yield determined for isocysteine is 5.1, whereas for cysteine G = 0.7). Sulfhydryl-containing substances which have been found to reduce the radiosensitivity of animals yield especially few sulfur radicals (cysteamine, cysteine, homocysteine, 5-mercaptopyridoxine, glutathione). The effect of additions of cysteine, pyridoxine, and sulfur-containing derivatives of the pyridoxine to the bovine serum albumin on the radiation-induced radical concentrations in the protein has been examined in various mixtures of different molecular structure. Both those compounds that proved to be radioprotective in animal experiments (cysteine, 5-mercaptopyridoxine) and those that are not (pyridoxine, 4-mercaptopyridoxine) produced strong changes in the radiation-induced radicals. In some compounds (sulfhydryl-containing aliphatic compounds, pyridoxine and its derivatives), irradiation with uv-light produced the same type of radicals as x-ray irradiation, whereas in other sulfur-containing substances, the two types of irradiation induced quite different radicals. The effect of long life radicals on the radiation damage induced has been investigated by means of polymethacrylate. The yields obtained for the break of the main chain and for the radical formation are compared. (GE)

9163 (COO-3221-30) HYDROPEROXYL RADICAL REACTIONS. III. Pulse-Radiolytic Study of the Reaction of HO_2 with Some Metal Ions. Progress Report, September 1, 1973–July 1, 1974. Meisel, D.; Ilan, Y. A.; Czapski, G. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1974. Contract AT(11-1)-3221. 29p. Dep. NTIS $4.50.

The reactions of $HO_2^{\cdot}$ with U(VI), Th(IV), and Ce(III) were studied by pulse radiolysis. Optical spectra of the U(VI) and Th(IV) complexes with $HO_2^{\cdot}$ were obtained as well as the rate of their formation and decay. Evidence is presented that Ce(III) is oxidized by $HO_2^{\cdot}$ radicals to give Ce(IV) and this rate was measured. (auth)

9164 (COO-3416-18) RADIATION CHEMISTRY AND MASS SPECTROMETRY OF VOLATILE SILANES AND GERMANES. Progress Report, June 1, 1973–May 31, 1974. Lampe, F. W. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). 1974. Contract AT(11-1)-3416. 30p. Dept. NTIS $4.50.

The three areas of investigation are: (1) Gamma radiolyses of silanes and germanes and of mixtures of these substances with organic compounds, free radical scavengers, and ion scavengers. (2) Mass-spectrometric studies of the ion-molecule reactions occurring when systems corresponding to those of (1) are subjected to ionization by electron impact. (3) Mass-spectrometric studies of gamma radiolyses of systems corresponding to those of (1). (LK)

9165 (IRE-5-1973) CRITICAL STUDY OF THE INDUSTRIAL APPLICATION OF GAMMA RADIATION IN THE FIELD OF CROSS-LINKING POLYMERS. Dardenne, P.; Schietecatte, W. (Institut National des Radioelements, Brussels (Belgium)). Dec 1973. 46p. (In French). Dep. NTIS (US Sales Only) $5.50.

A comparative examination was made of the possibilities of industrial applications by gamma rays and electron beam accelerators offered in the field of the cross-linking of polymers. After a brief study of the effects of ionzing radiation on polymers plus a description of a gamma irradiator and a linear accelerator, the physical characteristics and economic aspects of the two processes are compared. Different parameters influencing the choice are indicated. These selection criteria, based on the technological and/or economic aspects are not only valid in the case of the cross-linking of polymers but may also be of general use. (auth)

9166 (ORO-4059-4) RADIATION CHEMISTRY OF HIGH POLYMERS. Progress Report No. 4, May 1, 1973–May 1, 1974. Dole, M. (Baylor Univ., Waco, Tex. (USA)). 15 May 1974. Contract AT(40-1)-4059. 8p. Dep. NTIS $4.00.

The influence of polyethylene morphology on free radical production and decay was studied. Samples of hydrogenated polyethylene were irradiated with a gamma source. (LK)

9167 (TID-26575) INTERFACING THE BIOMATION 8100 TRANSIENT RECORDER TO A PDP-8 MINICOMPUTER FOR KINETIC MEASUREMENTS. Hobaugh, C. G.; Patterson, L. K.; Fessenden, R. W. (Mellon Inst. of Science, Pittsburgh (USA). Radiation Research Labs.). 28 Dec 1973. Contract AT(11-1)-3238. 20p. (SR-16). Dep. NTIS $4.00.

The Biomation 8100 interface to the PDP-8 computer system, developed in these Laboratories for kinetic measurements, is described in detail. The physical hardware requirements and connections needed are discussed and diagrams given. A general synopsis of the software functions is presented followed by specific examples of application to pulsed ESR experiments and optical pulse radiolysis. Program listings and flow diagrams for these examples are included. (auth)

9168 (UCID-16087) BIBLIOGRAPHY ON RADIATION EFFECTS ON PRIMARY AND SECONDARY EXPLOSIVES AND ON PROPELLANTS. Dobratz, B. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Jul 1972. Contract W-7405-eng-48. 25p. Dep. NTIS $4.25.

An attempt has been made to assemble in one document articles and reports on the subject of irradiation effects on explosive materials. The citations were taken from various sources. They are arranged alphabetically by author in three groups: (1) open literature items, (2) unclassified reports, and (3) classified reports. Comments are welcome for future revisions of this informal selected bibliography. (auth)

9169 (UCLA-34-P-184-X-1) FINAL REPORT ON NATURE AND ELECTRONIC STRUCTURE OF UNSTABLE SPECIES GENERATED IN GAMMA-IRRADIATED NUCLEIC ACID CONSTITUENTS. Period Covered: April 1970–April 1971. (California Univ., Los Angeles (USA). Lab. of Nuclear Medicine and Radiation Biology). 1974. Contract AT(04-3)-34. 51p.

The nature and electronic structure of unstable species generated in γ-irradiated aqueous solutions of nucleic acid constituents were studied by ESR. A $NaClO_4$ glassy matrix was prepared and applied to the study of various 5-halouracils, 5-methylcytosine, 5-methyldeoxycytidylic acid, and thymine. ESR spectra of bioorganic radical anions were obtained as were spectra of radicals formed by protein addition to the radical anions. Tentative interpretations were made of the electronic structures of the various radical products. (JGB)

9170 REVERSIBLE TRAP TO CARBANION ELECTRON TRANSFER IN γ-IRRADIATED HYDROCARBON GLASSES. Lin, D. P.; Willard, J. E. (Univ. of Wisconsin, Madison). J. Phys. Chem.; 78: No. 11, 1135-1136(23 May 1974).

Gamma irradiation of hydrocarbon glasses produces trapped electrons, radicals, and cations. Experiments in which the e_{tr}^- ir spectrum and photoconductivity are regenerated by 375-nm light after complete bleaching by ir light imply formation and subsequent photoionization of carbanions (or, less probably, impurity anions). Thus, anion formation and the retrapping process compete with the cations for mobile electrons. Experiments are reported which show that this competition is maintained through at least seven ir–uv bleaching cycles and that it does not change markedly over a 12-fold range of dose and radical concentration. (LK)

9171 PULSE RADIOLYSIS OF CYCLOPENTANE IN AQUEOUS SOLUTIONS. Rabani, J.; Pick, M.; Simic, M. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). J. Phys. Chem.; 78: No. 11, 1049-1051(23 May 1974).

The spectra and decay kinetics of C_5H_9 (C_5H_{10} represents cyclopentane) and $C_5H_9O_2$ radicals have been studied. These radicals were generated in aqueous solutions containing cyclopentane and N_2O in the presence and in the absence of O_2. The optical absorption of $C_5H_9O_2$ has a peak at 270 nm, ϵ 1450 ± 150 M^{-1} cm^{-1}. The following reaction rate constants have been measured: $\kappa(C_5H_9O_2 \times C_5H_9O_2) = (1.2 \pm 0.15) \times 10^7$ M^{-1} sec^{-1}, $\kappa(C_5H_9 + C_5H_9) = (1.0 \pm 0.2) \times 10^9$ M^{-1} sec^{-1}, $\kappa(C_5H_9 + O_2) = (4.9 \pm 0.6) \times 10^9$ M^{-1} sec^{-1}, and $\kappa(OH + C_5H_{10}) = (4.9 \pm 0.7) \times 10^9$ M^{-1} sec^{-1}. Neither C_5H_9 nor $C_5H_9O_2$ transfer electrons to tetranitromethane. $C_5H_9O_2$ does not decompose to produce O_2^-. (auth)

9172 RADIATION CHEMICAL STUDIES ON SYSTEMS RELATED TO ASCORBIC ACID. Radiolysis of Aqueous Solutions of α-Bromotetronic Acid. Schuler, M. A.; Bhatia, K.; Schuler, R. H. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 78: No. 11, 1063-1074(23 May 1974).

The radiolysis of aqueous solutions of α-bromotetronic acid has been examined in order to provide background information on the radiation chemical reactions of ascorbic acid. It has been shown that in the presence of an H atom donor its reaction with hydrated electrons results very nearly in the quantitative reduction to bromide ion and tetronic acid. Optical pulse radiolysis studies indicate, however, that the radicals produced as a result of the attack by hydrated electrons do not abstract hydrogen rapidly. These optical studies suggest that the radical anions expected to result from bromide elimination protonate very rapidly. Conductometric pulse radiolysis experiments confirm that the radicals present at microsecond times are neutral and show that ionic products are produced only at very much longer times following the disproportionation of these radicals. These studies make it evident that radical oxyanions having the structure $-C(O^-)=C-$ can protonate

very rapidly at the radical site. Oxidation of α-bromotetronic acid by OH produces bromide ion in 28% yield, presumably as a result of addition at the bromine position followed by loss of HBr. The majority of the OH radicals, however, appear to react either by addition to the 3 position or via electron transfer and do not yield bromide. ESR and optical pulse radiolysis studies show that the organic radical produced by oxidative debromination is a tricarbonyl radical anion identical with that present in the radiolysis of α-hydroxytetronic acid and very similar to the intermediate present in the oxidation of ascorbic acid. Both optical and conductometric pulse radiolysis studies confirm a yield ~30% for the dehydrobromination process and also show that the loss of HBr occurs rapidly (<1 μsec) and that the resultant radicals, which are relatively unreactive when present by themselves, disproportionate rapidly with other radicals produced in this system ($k \sim 10^9$ M^{-1} sec^{-1}). The present study shows that with α-bromotetronic acid addition of OH to the double bond is at least as important as electron transfer and indicates that addition is involved to an important extent in the oxidation of α-hydroxytetronic and ascorbic acids by OH radicals. (auth)

9173 ELECTRON SPIN RESONANCE STUDY OF THE RADIOLYSIS OF AQUEOUS SOLUTIONS OF CYANATE ION. Behar, D.; Fessenden, R. W. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 78: No. 11, 1074-1078(23 May 1974).

The in-situ radiolysis-ESR method has been used to investigate the radicals produced in aqueous solutions of cyanate ion (NCO^-) by high-energy electron irradiation. Over the pH range 3.6–12.4, N_2O-saturated solutions give rise to a proton-containing radical with the ESR parameters $a^N = 13.73$, $a^H = 10.87$ G, and $g = 2.00425$. From the dependence of the intensity of this spectrum upon flow rate and the concentration of NCO^- it is concluded that the radical is a primary product and most probably has the structure $HNCO_2^-$. Over the pH range 6.5–10.5 another radical which contains two nitrogen atoms and has the parameters $a^N = 9.82$, $a^{N'} = 5.90$, $a^H = 7.84$, and $g = 2.00404$ is observed. This radical can best be assigned as $-O_2CNHNCO_2-$ formed by a secondary reaction of OH with the dimer of the primary radical. Above about pH 12 yet another radical is found which also seems to be a secondary product. On the basis of earlier studies this radical can be assigned the structure $-O_2CNO_2-$. No radicals resulting from the reaction of e_{aq}^- with cyanate were found. Radicals which may have the structure RO_2CN^- were produced by allowing methyl and ethyl carbamate to react with HOCl and allowing the resultant N-chloro compounds to react with e_{aq}^- in basic solution. The spectra for the two esters were similar in their gross features with $a^N \sim 11$ G and $g \sim 2.0048$. (auth)

9174 HIGH ENERGY RADIATION-INDUCED SYNTHESIS OF ORGANIC COMPOUNDS. III. Addition to Carbon–Carbon Double Bonds. Kucera, J.; Chutny, B. (Nuclear Research Inst., Rez, Czech.). Radiat. Res. Rev.; 5: No. 1/2, 93-133(Apr 1974).

A bibliographic review is presented of all literature published up to the end of 1972. A few references are included from 1973. (251 references) (JSR)

9175 HIGH ENERGY RADIATION-INDUCED SYNTHESIS OF ORGANIC COMPOUNDS. IV. Other Synthesis. Kucera, J.; Chutny, B. (Nuclear Research Inst., Rez, Czech.). Radiat. Res. Rev.; 5: No. 1/2, 135-175(Apr 1974).

A bibliographic review is presented of all literature published up to the end of 1973. A few references are included from 1973. (257 references) (JSR)

9176 PULSE RADIOLYSIS IN THE USSR. Pikaev, A. K. (Inst. of Physical Chemistry, Moscow). Radiat. Res. Rev.; 5: No. 1/2, 177-198(Apr 1974).

A bibliographic review is presented of the experimental work being done in the USSR on pulse radiolysis. The principal directions of these studies are solvated electrons in different matrices, free radicals in inorganic and organic systems, the mechanism of radiolytic transformations in aqueous solutions of biologically important compounds, and the pulse radiolysis of alkali halides. (95 references) (JSR)

9177 HIGH ENERGY RADIATION-INDUCED SYNTHESIS OF ORGANIC COMPOUNDS. II. Oxidation, Halogenation, and Introduction of Sulfur-Containing Groups into Organic Substances. Chutny, B.; Kucera, J. (Nuclear Research Inst., Rez, Czech.). Radiat. Res. Rev.; 5: No. 1/2, 55-91(Apr 1974).

A bibliographic review is presented of all literature published up to the end of 1972. A few references are included from 1973. (303 references) (JSR)

9178 HIGH ENERGY RADIATION-INDUCED SYNTHESIS OF ORGANIC COMPOUNDS. I. Introduction, Isomerization, and Carbon-Skeleton Changes, Radiation Synthesis in Aqueous Solutions. Chutny, B.; Kucera, J. (Czechoslovak Atomic Energy Commission, Rez). Radiat. Res. Rev.; 5: No. 1/2, 1-54(Apr 1974).

A bibliographic review is presented of all literature published up to the end of 1972. A few references are included from 1973. (556 references) (JSR)

9179 INTERACTION OF HYDRATED ELECTRONS WITH THE PEPTIDE LINKAGE. Rao, P. S.; Hayon, E. (Army Natick Labs., MA). J. Phys. Chem.; 78: No. 12, 1193-1196(6 Jun 1974).

The reaction rate constants k of e_{aq}^- with a wide range of peptides having terminal $-NH_3^+$ and N-acetyl groups were determined in aqueous solutions, using the technique of pulse radiolysis. These rates were shown to be markedly dependent on the state of ionization of the terminal $-NH_3^+$ groups, the number of peptide linkages, and the overall charge on the peptide molecules. Amino groups in a β (or δ, γ) position are significantly less reactive than the corresponding α-amino peptides. The inductive effects on the peptide hydrogen $-CONH-$ affect the reactivity toward e_{aq}^-, supporting previous suggestions that e_{aq}^- interacts with the carbonyl group. The rate constants k have been shown to be directly proportional to base-catalyzed rates for ionization of the peptide hydrogen of the same peptides, as determined by NMR. A similar correlation has been found between k and the ionization constants of the carboxylic acids of the corresponding peptides. Transient optical absorption spectra have been observed from the reaction of e_{aq}^- with the N-acetyl derivatives of triglycine, hexaalanine, and trisarcosine. These spectra are dependent upon pH and are suggested to be formed from the interaction of e_{aq}^- with the carbonyl group of the peptide linkage. The ketyl radicals formed can undergo acid-base equilibration $-\dot{C}(O^-)NH- + H^+ \rightleftharpoons -\dot{C}(OH)NH-$, with pK_a (radical) ≥ 12.0. These ketyl radicals have very low (negative) redox potentials and are strong reducing agents. (auth)

9180 HYDROLYSIS AND RADIOLYSIS OF PROCESSES OF AQUEOUS SOLUTIONS OF TRYPTOPHAN. Petryaev, E. P.; Zhigunova, L. N.; Maksimuk, T. V.; Makarov, A. I. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 4, 26-30(1973). (in Russian).

In the present work the processes of hydrolysis and radiolysis of aqueous solution of tryptophan were investigated in dependence on irradiation type, CO_2 presence, and pH. The promoting action of γ-irradiation on the acid and basic hydrolysis of tryptophan is shown. The influence of standing time of solutions on the decay degree of tryptophan in aqueous solution is noted. (auth)

9181 EFFECT OF TEMPERATURE ON THE RATES OF REACTION OF EXCESS ELECTRONS IN LIQUID HYDROCARBONS. Beck, G.; Thomas, J.K. (Department of Chemistry and the Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). J. Chem. Phys. 60: No. 5, 1705-1706 (1 Mar 1974).

The effect of temperature on rates of reaction of electrons with biphenyl in n-hexane, cyclopentane, and iso-octane has been studied. The experimental data fit an Arrhenius plot of log k vs 1/T giving activation energies of 6.4, 4.2, and 0.51 kcal/mole, and A factors of 4.4×10^{16}, 4.9×10^{13}, and 3.2×10^{13} in n-hexane, cyclopentane, and iso-octane, respectively. The A factors for the reactions are discussed in terms of the quasi-free nature of the electron. (auth)

9182 ELECTRON SPIN RESONANCE OF γ-IRRADIATED ALKYL PHOSPHATES: THE C_2H_5 RADICAL IN MAGNESIUM DIETHYL PHOSPHATE (MgDEP). Bernhard, W.A.; Ezra, F.S. (Department of Radiation Biology and Biophysics, School of Medicine and Dentistry, The University of Rochester, Rochester, New York 14642). J. Chem. Phys. 60: No. 5, 1707-1710 (1 Mar 1974).

The major free radical product trapped at 77°K in γ-irradiated magnesium diethyl phosphate $[((C_2H_5O)_2PO_2)_2Mg]$ is the ethyl radical. The following principal values for the α and β proton hyperfine tensors were determined from ESR data obtained at the Q band: $A^\alpha_x = 15.9$, $A^\alpha_y = 20.6$, $A^\alpha_z = 25.5$; and $A^\beta_x = 26.0$, $A^\beta_y = 26.5$, $A^\beta_z = 27.6 \pm 0.5$ G. Significant reorientation of the ethyl radical occurs upon cleavage of the carbon oxygen bond. The assymetry in the α hyperfine tensor has been interpreted in terms of a twofold potential barrier to the rotation of the methylene group. Hindrance to the rotation of the methyl group, relative to the methylene, is apparent from differential line broadening within the spectrum at 77°K. (auth)

9183 ELECTRON SPIN RESONANCE OF γ-IRRADIATED ALKYL PHOSPHATES: THE $CH_3{:}CHOP(O)_2OC_2H_5$ RADICAL IN MAGNESIUM DIETHYL PHOSPHATE (MgDEP). Ezra, F.S.; Bernhard, W.A. (Department of Radiation Biology and Biophysics, School of Medicine and Dentistry, The University of Rochester, Rochester, New York 14642). J. Chem. Phys. 60: No. 5, 1711-1716 (1 Mar 1974).

The free radical species observed by ESR after γ irradiation of magnesium diethyl phosphate (MgDEP) at 77°K and annealing to 160°K

is $CH_3\dot{C}HOP(O)_2OC_2H_5$. The radical structure has been determined by deuterium and ^{13}C substitution in polycrystalline samples and by a single crystal analysis. Hyperfine principal values for the α hydrogen, β hydrogen, and phosphorous nuclei are: ($A_x^{H\alpha}$=−7.3 G, || to C–H bond; $A_z^{H\alpha}$=−15.8 G, || to p orbital; $A_y^{H\alpha}$ ~−27.5 G), ($A_z^{H\beta}$=25.2 G, || to C–C bond; $A_x^{H\beta}$ =22.2 G; $A_y^{H\beta}$=22.8 G), and (A_y^{P}=4.7 G, || to p orbital; A_x^{P}=6.1 G, ~|| to: C · · · P direction; A_z^{P} = 2.8 G). From the temperature dependency of the phosphorous hyperfine coupling and the single crystal analysis, it is concluded that the predominant mechanism for transfer of spin to the phosphorous is hyperconjugation. (auth)

9184 RADIATION CHEMICAL RESONANCE EFFECT IN SOLID 5-BROMODEOXYURIDINE; CHEMICAL CONSEQUENCES OF THE AUGER EFFECT. Halpern, A.; Stoecklin, G. (Kernforschungsanlage, Juelich, Ger.). Radiat. Res.; 58: No. 3, 329-337(Jun 1974).

The chemical consequences following the formation of inner-shell electron vacancies in Br atoms of solid 5-bromodeoxyuridine (BUdR), induced by monoenergetic fluorescence x-rays, were studied by means of ESR technique. The radical concentration per unit dose absorbed was determined as a function of x-ray energy. For BUdR it exhibits a resonance increase near the K-absorption edge of Br, while it remains constant in thymidine (TdR). The radiation chemical resonance effect can clearly be attributed to the consequences of the Auger effect. The results seem to indicate that Auger charging and subsequent molecular fragmentation rather than electron self-radiolysis is responsible for the observed damage. (auth)

9185 RADIOLYSIS REACTIONS OF MONODISPERSE POLYSTYRENE PARTICLES IN AQUEOUS IODIDE SOLUTION. Huh, Y. Athens, GA; Univ. of Georgia (1973). 168p. University Microfilms Order No. 74-4820.

Thesis (Ph. D.).

Aqueous suspensions of polystyrene microspheres of accurately known size have been subjected to ionizing radiation from a ^{60}Co source. The particles used had diameters of 0.109, 0.234, and 0.481 μ. The radiation intensity, over the course of the work, varied from 1.14 to 1.00×10^{16} eV/cc/sec. The suspensions are stable with regard to ionizing radiation to total doses of absorbed energy of at least 5×10^{20} eV/cc. This was confirmed by spectrophotometry and light-scattering studies. Coagulation did not occur on irradiation and there was no detectable change in particle size or shape that could be detected by these experimental techniques. Ionizing radiation does produce extensive cross-linking within the particles making them poorly soluble in ordinarily good solvents for polystyrene. (LK)

9186 RADIATION POLYMERIZABLE VINYL ESTER RESINS CONTAINING 2-OXAZOLINE AND GUANIDINE ADDITIVES. Mani, I. (to Dow Chemical Co.). US Patent 3,810,826. 14 May 1974. Filed date 13 May 1971. 6p.

The addition of at least about 0.3 wt % of 2-oxazoline, a guanidine or certain amines to a thermosettable mixture of a nonvolatile vinyl monomer and a polymerizable vinyl ester resin reduces the dosage level of ionizing radiation required to cure the mixture. (Official Gazette)

9187 IMPROVEMENTS IN THE MANUFACTURE OF PROTEIN FIBRES. Carroll-Porczynski, C. Z. British Patent 1,346,500. 13 Feb 1974. Filed date 24 May 1971. 7p.

Reference is made to the manufacture of synthetic fibers and particularly fibers manufactured from vegetable protein. Hitherto such fibers produced commercially have had only limited success and have not been cost competitive with other types of synthetic fibers. The object of the process described is the production of such fibers at lower cost. Various crop plants have been proposed as sources of the protein, but the difficulty is that the protein content has not been high enough relative to the cost of the raw material and that of extracting the protein, apart from the fact that many of the crops are in demand for food production. It has been found that when a wide range of crop plants are exposed to mutagenic treatment, for example by exposure of seed to ionizing radiation, with or without additional chemical treatment, certain mutagenic treatments favor a tendency for mutations to occur giving rise to an unusually high protein content in the seed and also in seed husks, bran, and the residues from oil extraction processes. Examples of crop plants producing suitable mutants are lupin, triticale and rape. The process preferably includes the step of subjecting the residue from the protein extraction step to bacterial action in order to yield further protein. A particular advantage of the process is that seed residues from oil extraction may be used as the raw material for protein extraction and this, in conjunction with the bacterial process mentioned, results in a very high degree of crop utilization with enhanced economy of fiber production, without utilizing raw materials that can be used for food production. Moreover the fibers produced may be utilized for the manufacture of synthetic meats. Experiments are described utilizing radiation-induced mutants of triticale, which is a cross between wheat and rye. The optimum radiation dose for triticale seed grain was found to be 15 to 20 kR ^{60}Co radiation at 33.7 kR/hr and temperature 15°C. The protein is extracted with aqueous NaOH. Some investigations are also described in the use of lupin and rape. (UK)

9188 CARBOXYLATION OF METHYLAMINE UNDER THE INFLUENCE OF VUV LIGHT AND ^{60}Co γ RAYS. Zich, A. (Oesterreichische Studiengesellschaft fuer Atomenergie GmbH, Siebersdorf); Getoff, N. Monatsh. Chem.; 103: No. 4, 1078-1090 (Jul 1972). (In German).

Comparative investigations for carboxylation of methylamine by formate or formic acid were carried out under the influence of vuv light (147 and 123.6 nm) and ^{60}Co γ rays. The formation of the main product, glycine, was studied as a function of dose, pH, and of the concentration of both reaction partners. Based on the absorbed energy (eV/ml) in the system the carboxylation process is more effective by vuv light than by ^{60}Co γ rays. Probable reaction mechanisms for the product formation are discussed. (auth)

9189 COMPUTER-CONTROLLED PULSE RADIOLYSIS SYSTEM. Patterson, L. K.; Lilie, J. (Carnegie-Mellon Univ., Pittsburgh). Int. J. Radiat. Phys. Chem.; 6: No. 2, 129-141(Apr 1974).

A computer-controlled pulse radiolysis unit for gathering data related to transient optical absorption has been developed around the PDP-8 minicomputer (Digital Equipment Corporation) and Biomation 8100 transient recorder. A substantial number of manual operations are eliminated and provisions are made for storage of kinetic and spectral data on paper or magnetic tape. It is shown that such a system may be constructed using facilities commercially available in the computer system with a minimum of additional circuitry required. Formats for storage and presentation of information are illustrated by application of the apparatus to several chemical systems. (auth)

9190 RADIATION-INDUCED RADICAL ADDITION REACTION OF ALDEHYDES TO 1,3,3,4,4,-PENTAFLUOROCYCLOBUTENE. Ueda, T.; Muramatsu, H.; Inukai, K. (Government Industrial Research Inst., Nagoya, Japan). Nippon Kagaku Kaishi; 1974: No. 1, 97-102(Jan 1974). (In Japanese).

The γ-radiation-induced radical addition reactions of several aldehydes, CH_3CHO, C_2H_5CHO, $n\text{-}C_3H_7CHO$, and $i\text{-}C_3H_7CHO$ to 1,3,3,4,4-pentafluorocyclobutene [1] were studied. In the addition of aldehydes to [1], the acyl radical attacked both the =CF side and =CH side of the unsymmetrical double bond, yielding the two isomers, $(\underbrace{CF_2)_2CH_2}CFCOR$ [4] and $(\underbrace{CF_2)_2CHFCH}COR$ [5]. The unsaturated 1:1 adduct, $(\underbrace{CF_2)_2CH=C}COR$ [6] and the 1:2 adduct, $ROCCH(\underbrace{CF_2)_2CH}COR$ [7] were also produced along with the 1:1 adducts. The 1:1 adducts, [4] and [5] were obtained in a ratio of 1:2 independent of the structure of the aldehydes. Although the adduct [5] was dehydrofluorinated upon standing at room temperature to yield the unsaturated adduct [6], the adduct [4] remained unchanged under the same condition. The order in apparent reactivity of aldehydes observed in the addition reaction was as follows: $n\text{-}C_3H_7CHO > C_2H_5CHO \geq CH_3CHO \gg i\text{-}C_3H_7CHO$. (auth)

9191 GAMMA-INDUCED RADICAL ADDITION REACTION OF ALCOHOLS TO POLYFLUOROCYCLOBUTENES. Ueda, T.; Muramatsu, H.; Inukai, K. (Government Industrial Research Inst., Nagoya, Japan). Nippon Kagaku Kaishi; 1974: No. 1, 92-97(Jan 1974). (In Japanese).

The γ-radiation-induced radical addition reactions of such alcohols as CH_3OH, C_2H_5OH, $n\text{-}C_3H_7OH$ and $i\text{-}C_3H_7OH$ to such polyfluorocyclobutenes as $(\underbrace{CF_2)_2CH=C}Cl$ [1], $(\underbrace{CF_2)_2CF=C}Cl$ [2], and $(\underbrace{CF_2)_2CH=C}F$ [3] were studied. In the case of [1] and [2], the attack of the α-hydroxyalkyl radicals to the cyclobutenes occurred exclusively on the =CH or =CF of the unsymmetrical double bond, yielding the corresponding 1:1 adducts. While, in the case of [3], the radicals attacked on either the =CH or =CF, yielding the two isomers, $(\underbrace{CF_2)_2CH_2}CFCRR'OH$ [7] and $(\underbrace{CF_2)_2CHFCH}CRR'OH$ [8]. The ratio of the two isomers varied markedly with the structure of the alcohols, and this was attributed to the steric effect of alkyl groups of the alcohols. (auth)

9192 CROSSLINKING OF OLEFIN COPOLYMERS CONTAINING KETONE GROUPS USING HIGH ENERGY RADIATION. Guillet, J. E.; Mills, D. US Patent 3,812,025. 21 May 1974. Priority Date 4 Oct 1967, United Kingdom of Great Britain and Northern Ireland. 8p.

Olefin copolymers containing ketone groups are cross-linked by treatment with high energy radiation such as γ rays or electron beams. (Official Gazette)

9193 RADIATION ANNEALING OF NEUTRON-IRRADIATED ARSENATES. Arnikar, H. J.; Dedgaonkar, V. G.; Barve, M. (Univ. of Poona, India). J. Univ. Poona; No. 44, 31-39(1973).

The distribution of radioarsenic between As(III) and As(V) states following (n,γ) reaction in sodium arsenate was determined. After irradiation for 20 hours with an Sb-Be ^{13}C (nominal) photoneutron source the initial retention obtained in the solid sample was 80%, while with a Pu-Be ^{5}Ci source it was only 63%. The higher initial retention in the former case is believed to be due to concurrent partial annealing by the γ-radiation accompanying the neutrons in the Sb-Be source. To verify this assumption, these samples were subjected subsequently to γ-radiation from a kilocurie ^{60}Co source. This resulted in heavy annealing effects amounting to dose on 100% retention in both cases. In similar experiments with aqueous solutions the initial retention values were 90 and 22% with Sb-Be and Pu-Be irradiations respectively and these also increased almost to 100% as a result of annealing by γ-radiation, the rise in the latter case being particularly steep. All the radiation annealing curves obtained for concurrent or subsequent γ-exposures to the neutron bombardment showed a characteristic rising pattern similar to the thermal annealing obtained at elevated temperatures. (auth)

9194 ELECTROCURE SYSTEM. Ishiwatari, J. (Nippon Electrocure Ltd., Tokyo). Toryo No Kenkyu; No. 84, 6-28(Apr 1972). (In Japanese).

The electron beam radiation curing method and system (hardening paints by irradiation) are explained. The method has many advantages compared to conventional methods. The advantages are hardening at normal temperature, hardening in a short time, no catalyzer, availability of 100% solid paints, reduction of space for facility, homogeneous hardening, economy, and improvement of performance of coating film. The following points, however, should be taken into consideration, that is, initial investment, limit due to products to be irradiated, and safety management. The electron-beam curing method is applied for the painting of wood boards, metal coils, plastics, and metal plates. The electron beam for the method is usually produced by electron accelerators of several hundred kV. Paints used for the method were developed. Some of them and their mechanism of hardening are illustrated in this paper. The curing system from painting to drying is also explained in this paper. (JA)

9195 RADIATION COPOLYMERIZATION OF TETRAFLUOROETHYLENE WITH HEXAFLUOROPROPYLENE. Naberezhnykh, R. A.; Sorokin, A. D.; Volkova, E. V.; Fokin, A. V. Dokl. Akad. Nauk SSSR; 214: No. 1, 149-151(1 Jan 1974). (In Russian).

The results of the study of the copolymerization of tetrafluoroethylene and hexafluoropropylene in the liquid phase were reported. The copolymerization reaction was initiated with ^{60}Co γ-radiation. The radiation copolymerization of the monomers takes place in a wide composition interval of the original materials. The dose output was 10 rad/sec. The effective activation energy was found to be 2.6 Kkal/mol. (tr-auth)

9196 DETERMINATION OF THE ELECTRON YIELDS ON RADIOLYSIS OF PYRIDINE BASES IN THE PRESENCE OF NITROUS OXIDE. Zatonskii, S. V.; Riskovets, V. E.; Saraeva, V. V. Vestn. Mosk. Univ., Ser. II. Khim.; 15: No. 1, 70-73(1974). (In Russian).

The formation of nitrogen on radiolysis of the nitrous oxide solutions in pyridine, heptane, and β-picoline was studied under the variation of N_2O concentration up to 2 mol/l. The electron yields and the relative rate constants of the electron reactions with pyridine bases and nitrous oxide were determined by the formal kinetic consideration of experimental data, the following reactions being taken into account, viz. $N_2O + e^{-1} \rightarrow N_2 + O^{-1}$, $O^{-1} + Py \rightarrow PyO^{-1}$, $PyO^{-1} + N_2O \rightarrow N_2 +$ products. (auth)

9197 THERMAL STABILITY AND RADIATION DAMAGE IN THE PHTHALOCYANINES. Boas, J. F. (Monash Univ., Clayton, Australia); Fielding, P. E.; MacKay, A. G. Aust. J. Chem.; 27: No. 1, 7-19(Jan 1974).

The thalocyanine (pc) complexes of a number of metals have been prepared. The EPR spectra of the paramagnetic pc complexes (VO^{2+}, Cr^{2+}, Mn^{2+}, Co^{2+}, Cu^{2+}, Mo^{2+}) show metal ion resonances, while those of the diamagnetic pc complexes (H_2^+, Na_2^+, Mg^{2+}, Ni^{2+}, Zn^{2+}, Pd^{2+}, Cd^{2+}, Sn^{2+}, Pt^{2+} and Pb^{2+}) generally give free spin resonances with $g \approx 2.003$ and linewidths less than 1 mT. The preparative conditions have been shown to affect the free spin concentration in H_2(pc). Irradiation also affects the EPR signal intensity in H_2(pc), Zn(pc), and Ni(pc), and there are also changes in the near-infrared spectra of most pc complexes. The results are due to the presence of two types of defect, the first arising from decomposition during crystal growth and the second arising from a possible local disorder in the crystals which is produced by γ-irradiation. The latter may be due to a cross-linking of adjacent pc molecules. Oxygen absorption does not seem to be the major factor in the origin of the free spin resonances. (auth)

9198 RADIOPHOTOLUMINESCENCE OF GAMMA-IRRADIATED HYDROCARBON GLASSES AT 77°K. Yamazaki, H.; Oka, K.; Sato, M.; Shida, S. (Tokyo Inst. of Tech.). Bull. Chem. Soc. Jap.; 47: No. 1, 31-33(Jan 1974).

The radiophotoluminescence (RPL) from γ-irradiated hydrocarbon glasses, i.e., 3-methylhexane, methylcyclohexane, and ethylcyclohexane, containing small amounts of various aromatics (1,3,5-trimethylbenzene, biphenyl, naphthalene, and 1,4-diazine) was investigated at 77°K by infrared-light irradiation. The spectra of the RPL consist of the fluorescence and phosphorescence of the guest aromatic molecule, and the ratio of the phosphorescence to the fluorescence intensity is larger than that in the photoexcitation, indicating the existence of another path to the triplet state. The RPL is quenched by the addition of N_2O, but it is not much affected by that of NH_3. A possible mechanism for the RPL is considered, and its analysis is given. (auth)

9199 COPOLYMERIZATION OF ACRYLONITRILE WITH 1-NITROPROPENE-1 UNDER THE EFFECTS OF γ RADIATION. Alaniya, V. P.; Gorlov, E. G.; Kuznetsov, N. G. (Moscow Inst. of the Petrochemical and Gas Industry). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 4, 579-581(1974). (In Russian).

The possibility of the radiation copolymerization of acrylonitrile with 1-nitropropene-1 under the effects of ^{60}Co γ-radiation was shown. Some regularities of the copolymerization reaction were calculated and it was established that the reaction proceeds by a radical mechanism. (tr-auth)

9200 POLYETHYLENE. Radiation Polymerization. Machi, S.; Yamaguchi, K.; Sugo, T. (Japan Atomic Energy Research Inst., Takasaki). Kogyo Zairyo; 21: No. 9, 45-50(Sep 1973). (In Japanese).

Developmental research has been carried out for making polyethylene by the radiation polymerization of ethylene, by Japan Atomic Energy Research Institute and Brookhaven National Laboratory over a period of more than 10 years. The object of Japan Atomic Energy Research Institute is to provide a method for making new polyethylene by removing the polyethylene crystallized during the polymerization in the form of slurry or bulk. The polymerization is effected at the temperature lower than the melting point of the polyethylene. An advantage of this method is that both the pressure and temperature of polymerization is relatively low. The apparatus comprises a slurry system which is a wet wall, central radiation source type. The pilot plant includes a 50-liter reactor with 410-kg/cm² design pressure. A ^{60}Co source of 13 kCi is inserted in the center portion of the reactor. The average dose rate in the reactor is about 3×10^5 rad/hr. The product polymer is removed from the reaction system in the form of slurry. The product is named TAKASEN®. The density is about 0.95 g/cc. The specific surface area is very large because of super-fine powder, and average particle diameter is about 8 to 20 microns. The product can be used as a material for ion exchange resin, adsorbent, material for plastic molding at room temperature, and sheet having 30% transparency. (JA)

9201 TREATMENT OF WASTE GAS BY IRRADIATION. Machi, S. (Japan Atomic Energy Research Inst., Takasaki); Kawamura, K. Genshiryoku Kogyo; 19: No. 10, 25-28(Oct 1973). (In Japanese).

The technology of preventing environmental pollution has been becoming extremely important in recent years, especially in connection with the exhaust gas from automobiles and thermal plants. The main pollutants in this case are sulfurous acid gas and nitrogen oxide. The method developed to remove these two substances from the exhaust gas in heavy-oil combustion is described both on basic experiment and experimental apparatus. The procedure is as follows: combustion gas, through an electric precipitation dust collector, is led into an irradiation box, where the gas is exposed to electron beam from an accelerator. Solid matter formed by irradiation in the box is then removed in another electric precipitation collector. Finally, the purified gas is released into the atmosphere. In this continuous process, nearly 100% of both substances can be removed. (JA)

9202 ESR STUDIES ON PRIMARY PROCESSES IN RADIATION-INDUCED REACTIONS. V. Polymerization of 1,3-Butadiene on Silica Gel at 77°K Studied by Computer Analysis. Shiga, T.; Okamura, S. (Kyoto Univ.). Polym. J.; 6: No. 1, 1-6(Mar 1974).

The primary processes of radiation-induced polymerization of 1,3-butadiene-1,1,4,4-d_4 on silica gel were investigated quan-

titatively by means of ESR. The spectra containing several superimposed components were analyzed by a computer. The cation radical of butadiene is formed by the interaction with irradiated silica gel. Polymerization is initiated by the butadiene cation radicals followed by the addition of butadiene molecules and terminated by the recombination between the propagating allyl-type cations and electrons. The rate constant of the first step of polymerization, i.e., the addition of the butadiene molecule to the butadiene cation radical is discussed. (auth)

9203 RADIATION-INDUCED HETEROGENEOUS POLYMERIZATION. II. Polymerization of Acrylonitrile in the Presence of DMF. Wada, T.; Takehisa, M. (Japan Atomic Energy Research Inst., Takasaki). Polym. J.; 5: No. 3, 255-262(Jan 1974).

The radiation-induced heterogeneous polymerization of acrylonitrile in the presence of DMF at 0 to 80°C was studied kinetically. The polymerization proceeded with precipitation of the polymer at mole fractions of the monomer higher than 0.4. The rate of polymerization in the steady state was proportional to the square root of the dose rate in the presence of DMF in contrast with a dose rate exponent of 0.9 in bulk polymerization. This fact indicates that the first-order termination by radical occlusion does not take place in this heterogeneous polymerization in the same way as in the homogeneous polymerization. This may be due to the larger mobility of the propagating chain due to the presence of DMF. The rate constant of the elementary reactions in the heterogeneous system (m = 0.54) at 35°C were determined to be $k_p = 2.6$, $k_t = 4.5 \times 10^2$, and $k_{trs} = 1.5 \times 10^{-3}$. (auth)

9204 PHYSICOMECHANICAL PROPERTIES OF γ-IRRADIATED TETRAFLUOROETHYLENE–VINYLIDENE FLUORIDE COPOLYMERS. Berlyant, S. M.; Gavlovskii, A. A. Plast. Massy; No. 8, 9-11(1973). (In Russian).

The effect of γ-irradiation in a vacuum on changes of the solubility and the thermomechanical and physicomechanical properties of copolymers of tetrafluoroethylene and vinylidene fluoride was studied. It was established that with increase of the concentration of the ethylene monomer units the cross-linking of the copolymer proceeds more rapidly. The dependence of the tensile strength of the copolymer on the absorbed dose and the experimental temperature was reported. (tr-auth)

9205 PREPARATION, STRUCTURE, AND PROPERTIES OF MEMBRANES OBTAINED BY RADIOCHEMICAL GRAFTING OF ACRYLIC ACID ON THIN TERPHANE FILMS IN THE PRESENCE OF SWELLING AGENTS. Marchand, J.; Puig, J. R. (Cen, Saclay, France). J. Appl. Polym. Sci.; 18: No. 4, 993-1012(Apr 1974). (In French).

The grafting of 6-μ thick films of poly(ethylene glycol terephthalate) (Terphane trademark) with acrylic acid leads to membranes usable in electrodialysis but not usable in inverse osmosis. This technique permits the γ-radioinduced grafting to be done under very satisfactory conditions. Data were obtained on the grafting kinetics, the swelling of the grafted films, their electrical resistance, their crystallinity, and their structure as shown by electron microscopy which permits a better understanding of the grafting mechanism and shows a direct correlation between the structure of the grafted films, the grafting conditions, and the properties of the resulting membranes. The role played by amorphous zones in this system is of primary importance: the amorphous zones alone are capable of receiving the acrylic acid and permitting the formation in their place of poly(acrylic acid). This poly(acrylic acid) is accumulated in the amorphous zones where its concentration approaches a limit determined concurrently by two factors. The first factor is that the physical barrier of the crystalline zones is opposed to the extension of the grafting. The second factor is that the reaction conditions themselves, to the extent where the matting or reticulation state which can be established between the poly(acrylic acid) chains ends by being opposed to the introduction of the monomer, can create a second limitation to the development of the reaction. Diphenyl used as a swelling agent appears to favor the extension of the amorphous zones by attack on the crystalline zones. It is possible that its presence leads to a poly(acrylic acid) of lower molecular weight and therefore of a less matted structure and more open to the diffusion of water. This would explain the fact that permeability to water was obtained only by grafting in the presence of diphenyl. Formic acid, also used as a swelling agent, seems to have an opposite result by having lower swelling rates. It is possible that this compound favors the formation of poly(acrylic acid) of high molecular weight resulting in a pseudo-gel by a matting that is not easily swelled. It is shown that under the conditions used the grafting of Terphane by acrylic acid approaches a limiting rate determined principally by the degree of crystallinity. The crystalline framework of the Terphane is practically unaltered. Its properties are variously affected by the processing. Water permeability and mechanical resistance are only slightly modified, whereas the electrical conductivity is increased considerably. (tr-auth)

9206 ELECTRON SPIN POLARIZATION EFFECTS IN A STUDY OF TRANSIENT HYDROGEN ATOMS IN ACIDIC ICES UNDER ELECTRON IRRADIATION. Shiraishi, H.; Kadoi, H.; Katsumura, Y.; Tabata, Y.; Oshima, K. (Tokyo Univ.). J. Phys. Chem.; 78: No. 13, 1336-1337(20 Jun 1974).

ESR spectra of H atoms formed in acidic ices in the temperature range −160 to 50°C were measured, and the chemically induced dynamic electron polarization (CIDEP) phenomenon of H atoms in the higher temperature region together with the motional narrowing of their line width was observed. A preliminary account of the experimental results is given, which revealed rather different aspects of the CIDEP phenomenon of H atoms. (LK)

9207 LINEAR AND SIGMOID DOSE-EFFECT RELATIONS: INVESTIGATIONS WITH GAMMA-IRRADIATED THYMINE-(METHYL-T) IN AQUEOUS SOLUTION AND IN THE SOLID STATE. Merwitz, O.; Otto, R. (Kernforschungsanlage, Juelich, Ger.). Radiat. Environ. Biophys.; 11: No. 1, 69-77(Mar 1974).

The example of thymine-(methyl-T) demonstrates that in the case of radiation damage to one type of molecule different dose-effect curves will occur depending on the state of the molecule. Radiation-induced tritium cleavage from an aerated aqueous solution of thymine-(methyl-T) shows a linear dose dependence without threshold, tritium cleavage from solid thymine-(methyl-T) follows a sigmoid dose-effect curve with threshold. The G-values for the tritium cleavage from dissolved thymine-(methyl-T) depend on the concentration of the solution, while the G-values for the tritium cleavage from solid thymine-(methyl-T) depend on the dose. The extent of radiation damage in the solid state and in solution is subject to comparative analysis, and the difference in dose-effect relations is discussed. (auth)

9208 CHARACTERISTICS OF PROTEIN THIOL GROUPS ON THE BASIS OF THEIR REACTING WITH β-HYDROXYETHYL-2,4-DINITROPHENYL DISULPHIDE. Part 2. Effect of ^{60}Co γ-Radiation on SH Groups of H-meromysin. Bitny-Szlachto, S. (Wojskowy Instytut Higieny i Epidemiologii, Warsaw). Acta Pol. Pharm.; 29: 453-458(1972). (In Polish).

In H-meromyosin irradiated with 10–45 krad of ^{60}Co γ-radiation and in control samples of the protein there were determined: the total SH assayed in the presence of 4.5 H urea, and SH of the native protein, reacting with 0.375 mM β-hydroxyethyl-2,4-dinitrophenyl disulfide (HEDD). Resolution of the time-course of the latter reaction into components, corresponding to reactions of particular types of thiol groups, gave contents of SH^{I}, SH^{II} and SH^{III} having under applied conditions half-reaction periods 20–50 minutes, 2–7 minutes and <2 minutes, respectively. Irradiation of the protein proved to reduce the content of SH by 0.28 μeq/krad per gram protein. Moreover, a slight increase in the content of the most reactive type of thiol groups (SH^{III}), ascribed to denaturation of the protein by irradiation, distinct decrease of content of SH^{II}, and less pronounced drops in contents of either SH^{I} and masked thiol groups were demonstrated in the irradiated protein. (auth)

Radiochemistry and Nuclear Chemistry

Refer also to abstracts 9107, 11489, and 11586.

9209 FIZICHESKIE OSNOVY RADIOKHIMII. (Physical Principles of Radiochemistry). Murin, A. N. Moscow; Izdatel'stvo Vysshaya Shkola (1971). 288p.

This textbook is for persons specializing in the use of radiochemical methods. The general properties of atomic nuclei, basic problems of natural and artificial radioactivity, methods for recording radioactive radiations, the interaction of radiation with matter, and nuclear reactions are discussed. The principles of methods using accelerator-charged particles and the obtaining of new elements of the periodic system are considered briefly. Special attention is given to the chemical results of nuclear transformations and methods of study based on nuclear processes, in particular, those based on the Moessbauer effect. The book is designed for students specializing in chemistry at the university. (~ 100 references) (tr-auth)

9210 ADVANCES IN INORGANIC CHEMISTRY AND RADIOCHEMISTRY. Volume 15. Emeleus, H. J.; Sharpe, A. G. (Eds.). New York; Academic Press, Inc. (1972). 457p. $15.50.

The following topics are considered: secondary bonding to nonmetallic elements; Moessbauer spectra of inorganic compounds–

bonding and structure; metal alkoxides and dialkylamides; fluoroalicyclic derivatives of metals and metalloids; and sulfur nitrides. (LK)

For an abstract of an individual chapter see: 9245.

Hot-Atom Chemistry

Refer also to abstract 10906.

9211 STEREOCHEMISTRY OF THE DECAY-INDUCED GAS-PHASE HALOGEN EXCHANGE IN DIASTEREOMERIC 2,3-DICHLOROBUTANES. Daniel, S. H. (Virginia Polytechnic Inst., Blacksburg); Ache, H. J.; Stoecklin, G. J. Phys. Chem.; 78: No. 11, 1043-1048(23 May 1974).

The stereochemistry of halogen-for-halogen substitution at asymmetric carbon atoms by decay-produced bromine and iodine species was studied in diastereomeric alkyl halide molecules such as d,l- and meso-2,3-dichlorobutane. Energetic ^{80}Br ions were generated via the ^{80m}Br(IT)^{80}Br nuclear process using $CF_3^{80m}Br$ as source and allowed to react with the substrate molecules while still possessing excess kinetic energy or after having become thermalized in collisions with argon atoms. ^{125}I ions were produced via the EC decay of ^{125}Xe. In unmoderated systems a predominance of retention of configuration was generally observed. In the presence of excess argon, however, the degree of stereospecificity of the reaction varies with the type of diastereomer used as substrate. In the case of the thermodynamically less stable d,l system the stereospecificity decreases from about 2.5 (as expressed by the ratio of retention to inversion) in the absence of Ar moderator to 0.4 at high Ar concentrations whereas, under the same conditions, only small changes in the stereospecificity are observed if the meso diastereomer is the substrate. The results are explained on the basis of an electrophilic substitution involving a front-side attack of a positive halogen ion. In the case of the d,l system the initially formed halocarbocation can then undergo two competing processes: excitation racemization or Cl^+ transfer, which, depending on the environment, can be kinetically or thermodynamically controlled. (auth)

9212 STUDY OF THE ^{65}Ni-RETENTION IN NEUTRON IRRADIATION OF NEUTRAL NICKEL COMPLEXES IN SOLUTION. Ndiokwere, C. L. Darmstadt, Ger.; Technische Univ. (1972). 125p. (In German).

Thesis.

The following complexes have been chemically prepared and studied: (a) bis-acetylacetone-ethylenediimine-nickel(II), (b) cyclopentadienyl-nickel(I)-nitrosyl, (c) hematoporphyrin-dimethylester-nickel(II), and (d) hematoporphyrin-nickel (II). After the elaboration of suitable methods for processing of the irradiated complexes and the controlling of radiochemical purity of the neutron-generated ^{65}Ni, the retentions in the different complexes were measured as a function of irradiation dose, concentration of the complex, solvent type, and finally as a function of the specific scavenger medium. Complex (a) showed a lower radiation stability, viz. the retention decreased remarkably with increasing radiation dose. Complexes (a), (b) and (d) which have a lower chemical stability, exhibit higher retentions compared to the more stable complex (c). In the case of (a) concentration-independent retentions of between 22% and 33% have been found according to the solvent used. (GE)

9213 UNIMOLECULAR DECOMPOSITION PRODUCTS RESULTING FROM THE REACTIONS OF FISSION-PRODUCT IODINE WITH METHANE. Kikuchi, M.; Church, L. B. (State Univ. of New York, Buffalo). Radiochim. Acta; 19: No. 3, 128-131(1973).

The unimolecular decomposition processes occurring after iodine substitution reactions with gaseous methane have been studied. The iodine was created by thermal-neutron-induced fission of ^{235}U. The unimolecular reactions were analyzed by trapping the iodine-containing products with I_2, Br_2, and C_2H_4. Most of the observed chemical decomposition produced iodocarbene and molecular H_2, rather than iodomethyl radicals resulting from H atom elimination. Compared to previously reported nuclear substitution reactions, little unimolecular decomposition was observed in these experiments. (GE)

Properties of Radioactive Materials

Refer also to abstracts 9100, 10035, 10058, 10075, 10142, and 10158.

9214 (AEC-tr-7457, pp 297-302) PREPARATION OF STANDARD NITRATE SOLUTIONS OF HEXAVALENT AND PENTAVALENT Np FOR BIOLOGICAL EXPERIMENTS. Khalturin, G. V.; Zhuravleva, A. K. 1972. Translated from pp 197-201 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

A method is described for the preparation of standard nitric acid solutions of Np(VI) for biological experiments, by acidulation from lower valent forms in 4 to 5M nitric acid, in the presence of sodium nitrite, with subsequent evaporation of the solution until dry, then dissolution of the residue in distilled water. A study was made of the stability of nitrate solutions of Np(VI), as related to pH of the medium and concentration of neptunium in the solution. It was established that the relative accumulation of pentavalent neptunium in Np(VI) solutions increases as the pH increases and concentration of neptunium in the solution decreases. A technique is described for the preparation of standard nitrate solutions of Np(V) for biological experiments, by reduction of nitrate solutions of Np(VI) with a pH of 2.0 to 4.0, using hydrogen peroxide and heat. (auth)

9215 (AEC-tr-7457, pp 303-308) PREPARATION OF STANDARD Pu NITRATE AND CITRATE SOLUTIONS FOR BIOLOGICAL EXPERIMENTS. Khalturin, G. V.; Sevast'yanova, E. P. 1972. Translated from pp 201-204 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

A technique is recommended for preparation of standard nitrate solutions of polymeric Pu(IV) with a pH of 1.0 to 2.0. The obtained HNO_3 solutions contained up to 25% ionic forms of Pu(IV), Pu(V), and Pu(VI). A method was refined for preparation of standard nitrate solutions of Pu(VI). It was found that Pu(VI) is stable for 3 months in solutions containing 2 to 12 m/liter nitric acid. Pu(VI) is unstable in solutions with a pH of 2.0. A method is proposed for preparation of standard citrate solutions of Pu(IV), Pu(VI), and polymeric Pu(IV). It was found that Pu(V) is very unstable in citrate medium. (auth)

9216 (BARC-520) BASIC PRINCIPLES OF INORGANIC REDOX REACTIONS IN AQUEOUS SOLUTIONS. Ghosh Mazumdar, A. S. (Bhabha Atomic Research Centre, Bombay (India)). 1971. 51p. INIS.

Basic principles of inorganic redox reactions in aqueous solutions are enumerated. Oxidation-reduction reactions are discussed and the importance of the thermodynamic approach is pointed out. Reactions involving disproportionation and chemical friction are also discussed. Methods for measuring the redox potential are indicated. The role of hydrated electrons in aqueous chemistry is emphasized. The relation between ionization potential, electron affinity, and redox potential is shown. The effects of charge and size of an ion in aqueous reactions and the dependence of the tendency for complex formation on the atomic weight are mentioned. Values of a standard potential of redox couples for elements like Am, B, Cd, Ce, and a few rare earths are listed. (INIS)

9217 (CNAEM-R-119) COMPLEX CHEMISTRY OF URANYL NITRATE-P-AMINOBENZOIC ACID SYSTEM. Bal, Y.; Erben, M. T. (Cekmece Nuclear Research Center, Istanbul (Turkey)). 1973. 5p. Dep. NTIS (US Sales Only) $4.00.

The complex formation between uranyl ion and p-aminobenzoic acid was investigated by spectrophotometry using 50% alcohol-water medium. The results indicate that even at very high relative concentrations, all the ligand is bound, so that the average number of ligand molecules complexed with one uranyl ion can exceed enormously the coordination number to reach values as high as 170 and even more. (auth)

9218 (COO-3221-29) HYDROPEROXYL RADICAL REACTIONS. II. Cupric Ions in Modulated Photolysis-EPR Experiments. Progress Report, September 1, 1972-July 1, 1973. Czapski, G.; Meisel, D.; Levanon, H. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1973. Contract AT(11-1)-3221. 19p. Dep. NTIS $4.00.

The reaction of $HO_2^\cdot$ radicals with Cu^{2+} ions was studied using flash photolysis-EPR techniques. Th(IV) ions were used as spin-traps for $HO_2^\cdot$ radicals, and decay kinetics of the long-lived Th-$HO_2^\cdot$ complex formed were studied in the presence of Cu^{2+} ions. It is concluded that a complex between Cu^{2+} and $HO_2^\cdot$ results, the stability constant for which is found to be $(5.1 \pm 1.0) \times 10^7$ M^{-1}, and the rate of its decomposition, yielding Cu^+ and oxygen, to be 30 ± 5 sec^{-1}. (auth)

9219 (NIIAR-P-185) COMPLEXING OF TRIVALENT AMERICIUM, CURIUM, CALIFORNIUM, PROMETHIUM, AND YTTRIUM IONS WITH DIOXYMETHYLPHOSPHINIC ACID. Vorob'eva, V. V.; Elesin, A. A.; Zaitsev, A. A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Melekess (USSR)). 1973. 15p. (In Russian). INIS.

The dissociation constant of dioxymethylphosphinic acid was determined at pK = 2.08 at an ionic force of $\mu = 0$ and $t = 25°C$. The composition and stability constants of the Am^{3+}, Cm^{3+}, Cf^{3+},

Pm^{3+}, and Y^{3+} complexes with this acid were determined by ion exchange on cationite at $\mu = 0.2$ and $t = 25°C$. The constants obtained were used for the calculation of the partition process on cationite at $\mu = 0.5$, acid concentration of 0.3, and pH = 2.5. Dynamic tests showed good agreement with the calculated results. It was shown that the reaction constant for the proton replacement for the reaction $Am^{3+} + HA \rightleftharpoons AmA^{2+} + H^+$ is practically equal to the reaction constants for ligands such as $H_2PO_4^-$ and CH_3POOH^-. Addition of the second anion to the M^{3+} ion is accompanied by some reinforcement of the bonds in comparison with those expected from electrostatic concepts. (tr-auth)

9220 (UCID-15644-74-1) GENERAL CHEMISTRY DIVISION QUARTERLY REPORT, JANUARY–MARCH 1974. Harrar, J. E. (comp. and ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd.]. Contract W-7405-eng-48. 36p. Dep. NTIS $5.00.

Progress in the following research areas is reported: applications of ion-selective electrodes; analysis of explosive composites; separation of HMX and nitrocellulose; vaporization of $UReO_2$; volatility of UO_2Cl_2; tracer-gas analysis for project Rio Blanco; simulation modeling of nuclear fuel processing plants; and oxidation of thorium in oxygen, humid air, and humid nitrogen. (LK)

9221 SYNTHESIS OF A NEW TYPE OF SIGMA-BONDED ORGANOURANIUM COMPOUND. Mono- and Bis[Tris(η^5-Cyclopentadienyl)Uranium]Ferrocene. Tsutsui, M.; Ely, N. (Texas A and M Univ., College Texas). J. Amer. Chem. Soc.; 96: No. 11, 3650-3651(29 May 1974).

Preparation and some properties of [tris(η^5-cyclopentadienyl) uranium]ferrocene and 1,1'-bis[tris(η^5-cyclopentadienyl)uranium] ferrocene are reported. (LK)

9222 COMPARISON OF THE FLUORINATIONS OF URANIUM DIOXIDE BY BROMINE TRIFLUORIDE AND ELEMENTAL FLUORINE. Sakurai, T. (Japan Atomic Energy Research Inst., Tokai). J. Phys. Chem.; 78: No. 12, 1140-1144(6 Jun 1974).

Uranium dioxide powder was fluorinated by gaseous BrF_3 and F_2, separately, in order to compare the characteristics of the two fluorinating agents. The BrF_3-UO_2 reaction proceeds under lower temperatures and a lower concentration of the reacting gas than the F_2-UO_2 reaction. The temperature dependence of its rate is very small; the apparent activation energy is only 1.6 kcal/mol. In the F_2-UO_2 reaction, the production of UF_6 was not observed below 390°C. The rate of this reaction increases remarkably with an increase in temperature; the apparent activation energy for this reaction is 26.0 kcal/mol. In both of these reactions, UO_2F_2 is formed as an intermediate, and the further uptake of fluorine in the solid is not observed in either case. The solution from the residue of BrF_3-UO_2 reaction contains trace amounts of bromine, which possibly arises by hydrolysis of the BrF_3 chemisorbed on the solid. Oxygen fluorides were not detected in the F_2-UO_2 reaction. The diffusion rate of the reacting gas onto the solid surfaces influences the rates of both reactions. The results indicate that the physical adsorption of BrF_3 functions as the precursor to its chemisorption, and that the adsorption of fluorine is activated and dissociative. (auth)

9223 DENSITIES AND MOLE VOLUMES OF BINARY [UCl_3–MeCl(Me = Na,K)] MELTS. Desyatnik, V. N.; Katyshev, S. F.; Raspopin, S. P. (Ukrainian Polytechnic Inst., Sverdlovsk, USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 3, 362-364(1974). (In Russian).

The temperature dependence of the density of molten UCl_3-NaCl and UCl_3-KCl was determined, and the data were used to calculate the mole volumes of the systems and their deviations from additivity. The melts become denser with increase in the radius of the alkali metal cation. (tr-auth)

9224 HOMOGENEITY RANGE IN THE SYSTEM UP(O). Takac, M.; Ban, Z. (Institut Rudjer Boskovic, Zagreb). Croat. Chem. Acta; 45: No. 4, 579-580(Apr 1973).

From the U filings and red-P (P/U ratio 1.1-1.3) reacting in sealed and evacuated silica capsules at 900°C for 2 to 3 weeks, UP and U_3P_4 phases were obtained. They were compacted into slabs and fired in a tungsten crucible at 1200 to 1300°C for 2 hours in vacuum (10^{-4} Torr). Decomposition of U_3P_4 gives more stable UP and P. The chemical analysis shows that the samples contain a large amount of O (0.54–7.10%). X-ray powder diffraction shows that O is not present as UO_2 and that all samples are single phase (FCC with the compositions ranging from $UP_{0.88}O_{1.18}$ to $UP_{0.88}O_{0.02}$). The average lattice parameter is $a = 5.585 \pm 0.005$ A. (auth)

9225 REVISION AND OPTIMIZATION OF METHODS OF LABELING SAND WITH GOLD-198. Perez Novara, A. M. Veracruz, Mexico; Instituto Technologico Regional de Veracruz (1973). 58p. (In Spanish).

Thesis.

One specific application of labeling is the study of the movement of sand in the sea. In such a study made in Salina Cruz ^{198}Au was the labeling isotope used. A major problem was the selection of the method for the fixation of the radioisotope. The different methods used to label sand with ^{198}Au were studied and analyzed. An economic analysis was made of the various methods. It was concluded that the optimum method consisted in processing the sand with concentrated HNO_3 followed by boiling with NaOH. The adsorption of Sn on the sand is an important intermediate step in the fixation of Au. This is followed by the fixation of Ag which is replaced by the ^{198}Au. (JSR)

9226 WET REFINING OF PHOSPHATIC YELLOW CAKE TO URANIUM DIOXIDE. Zaki, M. R.; Farah, M. Y.; El-Fekey, S. A. (Atomic Energy Authority, Cairo). Acta Chim. Acad. Sci. Hung.; 80: No. 2, 167-175(1974).

A wet method for the preparation of nuclear pure uranium dioxide from phosphatic liquors has been described. Skimming of phosphate and ferric iron has been performed before the photolytic reduction of U(VI) to U(IV), using ethanol. The inhibition of photoreduction by accumulated acetaldehyde, byproduced during insolation, was suppressed by hydrazine sulfate addition. The oxidisability and ageing of powders has also been investigated. (auth)

9227 EXPERIMENTAL STUDY OF AN HF ABSORPTION TOWER WITH KOH IN A PILOT PLANT FOR THE RECONVERSION OF UF_6 TO UO_2. Hugo del Valle Munoz, V.; Velasco Mendoza, V. M. Mexico City; Universidad Nacional Autonoma de Mexico (1974). 120p. (In Spanish).

Thesis.

In the reconversion of UF_6 to UO_2 an excess of HF is released. Its elimination by absorption with KOH in a packed tower was studied in a pilot plant installation. The theory of packed towers is analyzed in detail and the characteristics and operation of the pilot plant installation are given. The utility of the experimental results lies in the fact that the mass transfer coefficient is a determining factor in the dimensioning of the absorption equipment. The coefficient obtained is thus valid for the dimensioning of an industrial installation. (JSR)

9228 METHOD OF PURIFICATION OF URANIUM HEXAFLUORIDE. Carles, M.; Fra, J. (to Commissariat a l'Energie Atomique). US Patent 3,806,579. 23 Apr 1974. Priority date 8 Apr 1970, France. 4p.

This invention relates to a method of purification of uranium hexafluoride contaminated with impurities such as molybdenum hexafluoride and tungsten hexafluoride. The contaminated uranium hexafluoride is distilled from the liquid phase in the presence of chlorine trifluoride which forms an azeotrope with the impurities to be removed from the uranium hexafluoride. The impurities are withdrawn from the top of the column and the purified uranium hexafluoride is collected at the bottom of the column. (Official Gazette)

9229 PREPARATION OF RADIOIODINE-LABELLED COMPOUNDS FOR DIAGNOSTICS. Kocsar, L.; Kutas, V. (Frederic Joliot-Curie Sugarbiological es Sugregeszsegugyi Kutato Intezet, Budapest). Izotoptechnika; 17: No. 3, 147-154(Mar 1974). (In Hungarian).

Iodine labeling methods are compared and experiences in electrolytic iodine labelling are discussed. (auth)

9230 SYNTHESES AND STRUCTURE OF THE PRODUCTS OF ALLYL UREA IODINATION IN VIEW OF THEIR USE IN NUCLEAR MEDICINE. Schmidt, H. E. (Zentralinstitut fuer Isotopen- und Stahlenforschung, Berlin). Isotopenpraxis; 10: No. 4, 125-130(Apr 1974). (In German).

In analogy to the adsorption of mercury salts by allyl urea which, as is well known, yields neohydrin that has been used for a long time in nuclear medicine, experiments were carried through to label this compound with iodine by adding iodine monochloride. Paper-chromatographic separation of labelling products showed that addition of ICl in the beginning yields the expected acyclic iodination products, while in dependence of the labelling conditions cyclization takes place with separation of halogen hydrogen and formation of some iodine-labelled oxazoline derivate. (auth)

9231 STABILIZATION OF 4-IODINE ANTIPYRINE LABELLED WITH RADIOACTIVE IODINE ISOTOPES. Stanko, V. I.; Iroshnikova, N. G.; Zuikova, N. P. (Inst. of Biophysics, Moscow). Isotopenpraxis; 10: No. 4, 131-133(Apr 1974). (In Russian).

The influence of sodium nitrate on the storage stability of 4-iodine antipyrine labelled with iodine-131 was investigated. It was found that with specific activity being 500–1000 mCi/mmol the addition of 0.5 mg/ml of sodium nitrate provides storage stability of the drug to be 20 d. It is shown that the quantity of sodium

nitrate needed for stabilization depends on the specific activity of the drug. (auth)

9232 OXIDATION STATES OF ^{119}Sb AFTER THE EC DECAY OF ^{119m}Te in TeO_2 AND H_6TeO_6. Ambe, S.; Ambe, F.; Saito, N. (Inst. of Physical and Chemical Research, Saitama, Japan). Radiochim. Acta; 19: No. 3, 121-123(1973).

The oxidation states of ^{119}Sb after the EC decay of ^{119m}Te were investigated in solid TeO_2 and H_6TeO_6. The distribution of ^{119}Sb between the Sb(III) and Sb(V) states was found to depend markedly on the oxidation state of tellurium in the parent compounds. The oxidation states of ^{119}Sb arising in H_6TeO_6 were found to vary with the kind of the media used to dissolve the samples. The percentage distribution of ^{119}Sb in the Sb(III) state was much higher in the H_6TeO_6 samples stored as aqueous solutions than that in the solid samples. (GE)

9233 GAS PHASE AROMATIC SUBSTITUTION BY POSITIVE BROMINE AND IODINE IONS FROM ^{80m}Br(IT)^{80}Br AND ^{125}Xe(EC)^{125}I. Knust, E. J.; Halpern, A.; Stoecklin, G. (Kernforschungsanlage Juelich GmbH, Ger.). J. Amer. Chem. Soc.; 96: No. 12, 3733-3738(12 Jun 1974).

Gas phase aromatic bromination and iodination by positive bromine or iodine species resulting from the nuclear decay of ^{80m}Br(IT)^{80}Br and ^{125}Xe(EC)^{125}I, respectively, have been studied in simple aromatic systems of the type C_6H_5X (X = F, Cl, Br, CH_3). At high Ar- or Xe-moderator concentrations electrophilic substitution reactions of thermal positive halogen ions can be observed. The positional selectivity of the unsolvated Br^+ or I^+ ions is very low by solution chemistry standards; not only hydrogen substitution but also replacement of the substituent X takes place. In the case of Br^+ considerable rearrangement occurs in Br-for-H substitution in fluorobenzene, which increases with increasing concentration of Ar and decreasing total pressure. The results can be rationalized on the basis of excitation isomerization, which competes with collisional stabilization and proton transfer after the formation of an excited arenonium ion. For both bromine and iodine ions the ease of X replacement increases relative to that of hydrogen replacement from fluorobenzene to bromobenzene, and a concomitant increase of the relative amount of ortho substitution is observed. The formation of an aryldihalonium precursor is discussed. (auth)

9234 RAPID SYNTHESIS OF QUINOFORM LABELED WITH ^{131}I OR ^{125}I. Ando, A. (Kanazawa Univ., Japan); Nitta, K.; Hisada, K.; Ogata, M. Radioisotopes (Tokyo); 23: No. 1, 22-25(Jan 1974). (In Japanese).

In order to investigate the relations between SMON and Quinoform, rapid synthesis of Quinoform-^{131}I, -^{125}I was developed. This method of the synthesis is as follows: 10 mCi of sodium iodide-^{131}I, -^{125}I (0.2 ml) was added to a solution of iodine monochloride (45.5 mg) in 3 ml of concentrated hydrochloric acid under stirring and stirring was continued for 10 minutes. 5-Chloro-8-hydroxy-quinoline (50 mg) was added to this solution with stirring: a deep yellow crystalline solid precipitated out instantaneously. Stirring was continued for 5 minutes after the addition of 5-chloro-8-hydroxy-quinoline. The crystalline solid was then centrifuged, washed with concentrated hydrochloric acid. This crystalline solid was decomposed by being added to water under stirring. The precipitate was centrifuged, washed with water and 2% sodium thiosulfate solution to give a brownish white powder (Quinoform-^{131}I, -^{125}I, 4 mCi (radiochemical yield 40%). Radiochemical purity of this compound was bery pure by radiopaper chromatography and isotope dilution method. This method of the synthesis is excellent for the purpose of producing Quinoform-^{131}I, -^{125}I, because the procedures were very simple and complete in a short time. (auth)

9235 STUDY OF BENZIMIDAZOLE AND ITS DERIVATIVES. I. Synthesis of ^{14}C 2-Benzimidazole. Luu Duc, C. (Univ., Grenoble, France); Agnius-Delors, C. Bull. Soc. Chim. Fr.; No. 12, 3317(Dec 1973). (In French).

Benzimidazole was synthesized from ^{14}C-labeled formic acid condensed with o-phenylene diamine. The overall radioactivity yield measured by liquid scintillation is 48%. The radiochemical purity of the benzimidazole thus obtained was controlled using thin layer chromatography, its specific activity being 35 μCi/mM. (FR)

9236 POLYNUCLEAR DIORGANO-PHOSPHATO AND -PHOSPHONATO METAL COMPLEXES. Characterization Studies and Physicochemical Correlations. Mikulski, C. M.; Karayannis, N. M.; Pytlewski, L. L. (Drexel Univ., Philadelphia). J. Inorg. Nucl. Chem.; 36: No. 5, 971-981(May 1974).

From 161st National Meeting of the American Chemical Society; Los Angeles, CA (28 Mar 1971).

A series of new and previously reported M(III) (M = Al, Ti, V, Cr, Fe, Dy) and M(IV) (M = Th, U) polynuclear (-O-P-O-bridged) complexes with several diorgano-phosphato and -phosphonato ligands (n- and iso-alkyl-, aralkyl- or aryl-substituted) were prepared and characterized by means of spectral, magnetic and x-ray powder diffraction studies. Spectral data (ν_{PCO}, ν_{M-O}, Dq) were correlated to the $\Sigma\sigma$ substituent constant (Hammett constants, as modified by Kabachnik for organo-phosphorus compounds). Linear ν_{PCO} (asym) vs $\Sigma\sigma$ plots were obtained; the ν_{PCO} (asym) frequency increases with decreasing ligand-field strength. The ν_{M-O} vs $\Sigma\sigma$ plots are considerably more complicated in the cases of 3d metal ion than in Al(III) or Dy(III) complexes; Dq vs $\Sigma\sigma$ plots for Ti(III) and V(III) complexes are also complicated. The non-linear trends observed in 3d metal ion ν_{M-O} or Dq vs $\Sigma\sigma$ plots are discussed in terms of the combination of inductive and steric effects in determining the degree of metal-ligand back-donation. The subnormal magnetic moments of several M(III) (M = Ti, V, Cr, Fe) and U(IV) complexes suggest that the 3d or 5f electrons of these metal ions participate in magnetic exchange. The Dy(III) complexes are magnetically normal, as expected. (auth)

9237 ELECTROMETRIC STUDY OF THORIUM(IV) FURFURYL MERCAPTAN. Saxena, R. S.; Sheelwant, S. S. (Malaviya Regional Engineering Coll., Jaipur, India). J. Indian Chem. Soc.; 50: No. 7, 455-457(Jul 1973).

The complexation of thorium (IV) with furfuryl mercaptan has been studied in 50% ethanolic media applying potentiometric and conductometric titration techniques. The formation curves reveal the formation of 1:3 and 1:4 complexes whose log K stability values have been determined at 25, 35, and 45° at ionic strength of 0.5 M ($NaClO_4$) employing Calvin and Melchior's extension of Bjerrum's method. The values of ΔG, ΔH and ΔS for the complexation reaction have also been reported. (auth)

9238 SIMPLE, RAPID, AND EFFICIENT PREPARATION OF ^{99m}Tc-COMPOUNDS BY ELECTROLYSIS. III. ^{99m}Tc-PHOSPHATE. Ikeda, I.; Inoue, O.; Uchida, J.; Sugisawa, Y. Kurata, K. (Dainabot Radioisotope Labs., Ltd., Tokyo). Radioisotopes (Tokyo); 23: No. 1, 17-21(Jan 1974). (In Japanese).

As previously reported, electrolysis is one of the most convenient methods for labelling of several kinds of compounds with ^{99m}Tc. This method was expanded into other compounds such as bleomycin and chain phosphates, which are used as a tumor localizing agent and bone scanning agents, respectively. ^{99m}Tc-chain phosphates, such as polyphosphate (n = 12), tripolyphosphate and pyrophosphate were prepared by adding $^{99m}TcO_4^-$ soln. to Sn-chain phosphates solutions which were previously produced by electrolysis. The efficiency of labelling averaged more than 90% by allowing this mixture to stand for about 5 min. From the results of organ distribution study of ^{99m}Tc-chain phosphate with mice, we concluded that ^{99m}Tc-pyrophosphate is a better bone scanning agent than the other two polymerized phosphates. The results of further investigation showed that electrolysis method can be applied for labelling of several other compounds such as penicillamine and phytate. (auth)

9239 CONDENSED EQUILIBRIA IN THE URANIUM(III)–URANIUM(IV) FLUORIDE SYSTEM. Thoma, R. E.; Insley, H.; Brunton, G. D. (Oak Ridge National Lab., TN). J. Inorg. Nucl. Chem.; 36: No. 5, 1095-1098(May 1974).

The phase diagram of the condensed system UF_3-UF_4 was established experimentally. The system is characterized by the occurrence of a single eutectic invariant point, at 32 mole % UF_3, m.p. 865°C; by the absence of intermediate compounds; and by the behavior of UF_3 acting as crystalline solvent for U^{4+}. Solid state equilibria were found to differ substantially from those reported previously by British and Russian workers. Uranium(IV) was found to undergo substitutional solid solution in UF_3, reaching a maximum solubility at the solidus at UF_3-UF_4(67-33 mole %). As was to be expected analogous solution behavior with UF_4 acting as a solute for U^{3+} does not occur. (auth)

9240 QUANTITATIVE DETERMINATION OF CHOLESTERYL 14-METHYLHEXADECANOATE BY RADIO–GAS CHROMATOGRAPHY. Helmich, O.; Hradec, J. (Oncological Inst., Prague). J. Chromatogr.; 91: 505-512(24 Apr 1974).

A method was developed for the quantitative determination of radioactive cholesteryl 14-methylhexadecanoate at picomole levels. Intact cholesteryl esters are separated by gas–liquid chromatography on OV-1 silicone, one portion of the effluent being led to the flame ionization detector and the other portion combusted to $^{14}CO_2$. For qualitative analyses the radioactivity is assayed by continuous gas flow counting. For quantitative purposes the radioactive gas is trapped in ethanolamine; fractions are collected according to the mass record and the radioactivity is determined by liquid scintillation counting. The latter technique is able to detect 1–2 pmoles of radioactive cholesteryl esters with a reproducibility within ±10% and is suitable for the quantitative determination of these compounds enzymatically synthesized in vitro. (auth)

9241 ISOTOPIC SYNTHESES WITH PARTICULAR REFERENCE TO ^{14}C. Benakis, A. (Univ., Geneva). pp 11-19 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

A review is given of the factors to be considered in relation to the preparation of synthetic labelled compounds for research. The development of a new preparative method should proceed in the following steps: preliminary study, preliminary non-radioactive synthesis, preliminary labelled synthesis, and final labelled synthesis with high specific activity. Some commonly used reaction sequences are outlined. Limitations and economic aspects are also discussed. (auth)

9242 APPLICATION OF GAS–LIQUID CHROMATOGRAPHY TO ANALYSIS OF CARBON-14 BIOSYNTHETICALLY LABELLED COMPOUNDS. Matucha, M. (Inst. for Research, Production, and Application of Radioisotopes, Prague); Svoboda, V.; Smolkova, E. J. Chromatogr.; 91: 497-504(24 Apr 1974).

Preparations of higher fatty acids and amino acids of 10–60 mCi/milliatom C specific activity, obtained from algae grown in a $^{14}CO_2$ atmosphere, were analyzed by gas–liquid chromatography and radiochemical and chemical purities, content and specific activity of isolated compounds and mixtures were determined. Special attention was paid to the distribution of carbon-14 in the individual carbon positions in the fatty acids obtained by common labelling procedures. The results enable the choice of optimal growth conditions for the preparation of uniformly labelled compounds. In addition to mass detection, radioactivity was simultaneously detected by a gas-flow proportional counter, with digital and rate-meter outputs, after combustion on CuO of the split stream. (auth)

9243 PURITY OF RADIOLABELED CHEMICALS. Merrill, E. J.; Lewis, A. D. (Warner-Lambert Research Inst., Morris Plains, NJ). Anal. Chem.; 46: No. 8, 1114-1116(Jul 1974).

Examination of over 360 radiochemicals revealed 3.3% errors due to mislabeling. A quality control program to determine purity of radiolabeled chemicals is described. (auth)

9244 ACTINIDE ELEMENTS. Bagnall, K. W. Topics in Inorganic and General Chemistry, Monograph 15. New York; Elsevier Publishing Company (1972). 282p.

This account of the actinides covers their discovery and occurrence or synthesis, oxidation states, separation and purification, chemical and physical properties, and compounds and complexes. (LK)

9245 METAL ALKOXIDES AND DIALKYLAMIDES. Bradley, D. C. (Queen Mary Coll., London). Advan. Inorg. Chem. Radiochem.; 15: 259-322(1972).

The chapter on metal alkoxides and dialkylamides covers: alkali metal alkoxides; alkoxides of beryllium, magnesium, zinc, and alkaline earths; aluminum and gallium alkoxides; transition metal alkoxides; alkoxides of lanthanides and actinides; double alkoxides; metal trialkylselyloxides; and preparation and chemical and physical properties of metal dialkylamides. (LK)

9246 KINETIKA REAKTSII AKTINOIDOV. (Reaction Kinetics of the Actinides). Koltunov, V. S. Moscow; Atomizdat (1974). 312p.

This study deals with the oxidation and reduction of ions of uranium and the transuranium elements in solution. Basic information is presented on the rate, stoichiometry, and equilibrium of oxidation-reduction reactions of actinide elements from uranium to lawrencium. The effect of anions on reaction kinetics is considered. Rate constants, activation energies, and thermodynamic parameters are given. Possible reaction mechanisms are also discussed. The oxidation-reduction properties of curium and the transcurium elements are presented in a qualitative fashion primarily. This study covers work published up to the beginning of 1973. (SJR)

9247 EQUILIBRIUM PRECIPITATION OF PROTACTINIUM OXIDE FROM MOLTEN LiF-BeF_2-ThF_4-UF_4-PaF_5 MIXTURES BETWEEN 535 AND 670°C. Tallent, O.K.; Ferris, L. M. (Oak Ridge National Lab., TN). J. Inorg. Nucl. Chem.; 36: No. 6, 1277-1283(Jun 1974).

Molten LiF-BeF_2-ThF_4-UF_4(71.9-16-12-0.1 mole %) containing dissolved PaF_5 was equilibrated with various H_2O-HF-Ar gas mixtures at 535-670°C. The data obtained indicate that the protactinium was precipitated as Pa_2O_5 and, hence, that the reaction involved was $PaF_{5(d)} + 5/2H_2O_{(g)} = 1/2Pa_2O_{5(s)} + 5HF_{(g)}$, for which the equilibrium quotient is $Q_1 = P^5_{HF}P^{-5/2}_{H_2O}N^{-1}_{PaF_5}$. The values of Q_1 derived from the data can be expressed as $\log Q_1 = [12.50 - 10,690/T(°K)] \pm 0.2$. In these expressions (d), (s), (g), P, and N denote dissolved component, solid, gas, partial pressure (atm), and mole fraction, respectively. The point at which uranium oxide began to precipitate along with protactinium oxide was determined at several temperatures, using salt mixtures with different UF_4 concentrations. These data were considered in terms of the equilibria $UF_{4(d)} + 2H_2O_{(g)} = UO_{2(ss)} + 4HF_{(g)}$ and $1/2Pa_2O_{5(s)} + 5/4UF_{4(d)} = PaF_{5(d)} + 5/4UO_{2(ss)}$, in which (ss) denotes UO_2–ThO_2 solid solution. The respective equilibrium quotients can be expressed as $\log Q_2 = [9.27 - 8966/T(°K)] / 0.08$ and $\log Q_3 = [-0.827 - 590/T(°K)] \pm 0.1$. These results are consistent with the estimated thermodynamic properties of protactinium compounds. (auth)

9248 FORMATION OF U(V) IN A MOLTEN FLUORIDE SALT AT 550 TO 650°C BY REACTION OF GASEOUS UF_6 WITH DISSOLVED UF_4. Bennett, M. R.; Ferris, L. M. (Oak Ridge National Lab., TN). J. Inorg. Nucl. Chem.; 36: No. 6, 1285-1290(Jun 1974).

The reaction of gaseous UF_6 with UF_4 dissolved in molten LiF–BeF_2–ThF_4 (72-16-12 mole %) was studied over the temperature range 550–650°C. Chemical and spectrophotometric evidence showed that U(V) was formed in the salt according to the reaction $UF_{6(g)} + UF_{4(d)} = 2UF_{5(d)}$, in which (g) and (d) denote gas and dissolved species, respectively. The studies were conducted using gold apparatus, since gold was the only material found to be inert to both gaseous UF_6 and dissolved UF_5. When UF_5 was present in low concentration it disproportionated slowly according to the reverse of the above reaction; the rate was second-order with respect to the UF_5 concentration. The results indicated that, when UF_5 was present in high concentrations, its vaporization from the salt and subsequent disproportionation in the vapor phase were significant. Under all conditions studied, however, the pressure of uranium-containing species in the vapor phase was less than 0.004 atm. (auth)

9249 COMPLEX FORMATION BETWEEN METAL IONS AND AROMATIC PHOSPHONIC ACIDS. II. Nuallain, C. O. (Univ. Coll., Galway, Ireland). J. Inorg. Nucl. Chem.; 36: No. 6, 1420-1421(Jun 1974).

Stability constants of UO_2^{2+} and Fe^{3+} complexes with 2-hydroxylphenyl-phosphonic acid were determined. (UK)

9250 NOVEL SYNTHESIS OF TRISCYCLOPENTADIENYL PLUTONIUM(III). Crisler, L. R.; Eggerman, W. G. (Dow Chemical Co., Golden, CO). J. Inorg. Nucl. Chem.; 36: No. 6, 1424-1426(Jun 1974).

The preparation of triscyclopentadienyl plutonium(III) by reacting either hexachloroplutonate(III) or dicesiumhexachloroplutonate with magnesium biscyclopentadinide or trichloroplutonium (III) with cyclopentadinide is described. The reaction involving dicesiumhexachloroplutonate(IV) is preferred because it is rapid and because the Cs_2PuCl_6 is easy to prepare and only slightly hygroscopic. (UK)

Radioactive Waste Treatment

Refer also to abstracts 9272, 9677, 11807, and 11987.

9251 (ARH-2816) SPECTROPHOTOMETRIC DETERMINATION OF NITRATE WITH 4,4'-DIAMINODIPHENYLSULFONE. Winters, W. I. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Feb 1974. Contract AT(45-1)-2130. 46p. Dep. NTIS $5.50.

Nitrate reacts with 4,4'-diaminodiphenylsulfone (DDS) in concentrated sulfuric acid to form a yellow dye whose absorbance at 410 nanometers has been used for the spectrophotometric determination of nitrate in synthetic nuclear waste. The optimum sample volume and sulfuric acid and DDS concentrations for color development were determined. Twenty-three potential interfering ions were studied and their tolerance limits measured. Sodium hydroxide, acetic acid, and urea did not seriously interfere even at high levels. The effect of nitrite on the determination of nitrate was established and methods to destroy nitrites in acidic and basic media using urea are described. Even though a method for the total removal of nitrite was not found, a technique for measuring nitrate in the presence of five times more nitrite is discussed. Halide interference is removed by the addition of silver sulfate. The method has a molar absorptivity of approximately 2400 liter $mole^{-1}$ cm^{-1}. The method has been used to analyze synthetic nuclear waste and has a standard deviation of ±7.3% at the 100 μg nitrate level and ±2.4% at nitrate levels greater than 200 μg. (auth)

9252 (BARC/I-237) DESIGN CONSIDERATIONS AND TESTING OF CHARCOAL ADSORBER FILTERS. Jauhri, G. S. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 13p. INIS.

Activated charcoal adsorber filters are widely used for routine and post-accident gas cleaning in radiochemical plants and nuclear reactors. The principal fission-product gas to be filtered being radioiodine. Radioiodine can exist in various physical and chemical forms, e.g., inorganic and organic iodine, which ultimately governs the design of the clean-up system. Factors determining the choice of type and amount of charcoal for a particular system are described. As the activated charcoal undergoes degradation for a variety of reasons, periodic tests to determine its efficiency and the overall performance of the filter system are essential. The test procedure using radioiodine tracer is described in detail. The combined charcoal-cumabsolute filter, used in the Rajasthan Atomic Power Station, has been tested on site using the radioiodine tracer test and the results are reported. (auth)

9253 (BNWL-1826) RESEARCH AND DEVELOPMENT ACTIVITIES, WASTE FIXATION PROGRAM. Quarterly Progress Report, January–March 1974. McElroy, J. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1974. Contract AT(45-1)-1830. 64p.

Six runs were completed with the spray calciner and Inconel melter. In one run, where ruthenium volatilization was followed, about 2.4% of the feed ruthenium was observed in the calciner-melter condensate and none in the caustic scrubber solution or downstream gas samples. In the sixth run, DSS-15, a 510-hour run was completed in which 11,300 liters of PW-4b feed was calcined and 2.4 metric tons of borosilicate glass was produced. Data from this run are still being analyzed. Development of the ceramic electrode heated melter was continued. Salt water solution tests are being utilized to design the melter geometry and electrode configuration. One melter startup technique was demonstrated that utilizes direct glass melting by a radiant heater placed above the melter. Calculations for scale-up of a stirred Inconel metallic melter indicate that a 22-in.-diam melter with a melt depth of 18 in. should be capable of handling the high-level waste from a 5-metric ton per day fuel reprocessing plant. Optimization studies with a PW-6 (high sodium content) borosilicate glass formulation indicated that the best glass, in terms of leach rate, homogeneity, and melt viscosity, should contain about 10 wt % B_2O_3 and no CaO or MgO. Irradiation tests of simulated high-level waste calcine, containing approximately 0.5 wt % water, revealed that (1) the overall production rate of H_2 and O_2 from the radiolysis of water vapor is low, (2) much larger quantities of NO_x are initially formed but further irradiation appears to decompose the product gases, and (3) the largest contribution to gas generation appears to come from organic impurities in the waste yielding CO, CO_2, CH_4 and low molecular weight organic gases. Leach testing of waste calcine particles coated with either pyrolytic carbon (PyC) or PyC and silicon carbide, reveal that the leach rates are small when compared to a very leach resistant Pyrex glass. A comprehensive safety and systems evaluation for the definition and investigation of nuclear waste management systems is well underway. This study will evaluate waste management systems in relation to the containment, immobilization, and isolation of hazardous waste and will evaluate the radiological implications of these systems. (auth)

9254 (BNWL-tr-114) IODINE FILTER PROGRAM. Wilhelm, J.; Dillmann, H. G.; Gerlach, K.; Schuttelkopf, H. (Kernforschungszentrum Karlsruhe (F.R. Germany)). 9 May 1974. Translation of excerpt from KFK-1565. 26p. Dep. NTIS $4.50.

Progress is reported in the following research areas of the filter program: development of fission iodine adsorbers on an anorganic basis; investigations on impregnated active coal and filters on fission iodine precipitation; iodine filter test stand; breathing filters for precipitation of fission iodine; and development of an iodine monitor. The complete report was indexed previously and appeared as abstract 26: 50021. (LK)

9255 (CEA-R-4463) DETERMINATION OF STRONTIUM AND ITS IMPURITIES IN SOLUTIONS FROM A PILOT PURIFICATION PLANT. Kertesz, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). May 1974. 100p. (In French). Dep. NTIS (US Sales Only) $8.00.

Fission product solutions from the pilot plant for the purification of strontium contain alkaline earth elements and silver. Analytical control of the chemical process is described. It is divided into three parts. The first is the utilization of a cationic resin chromatographic separation for solutions containing similar concentrations of alkaline earths and silver. Selective elution of the constituents is made using ammonium malonate with a concentration gradient. The precipitation of silver malonate is avoided by forming a soluble anionic complex with the silver. Determinations are performed on the recovered fractions using a conductometric method applicable to very dilute solutions. Secondly, the radiochemical determination of ^{90}Sr is effected using a liquid scintillator. The method used to perform determinations in the presence of ^{90}Y involves the plotting of two curves: variation of the ^{90}Y contribution factor and yield, as a function of quenching. This method is compared to that using the chemical separation of ^{90}Y. Thirdly, in the case of strontium rich solutions containing alkaline earths and silver in the impurity state, investigations were carried out using spectrographic emission and the Breckpot method. A statistical method was used to verify the calibration curves for Mg, Ca, and Ba. (auth)

9256 (SGAE-2252) REMOVAL OF THE EXCESS NITRIC ACID IN RADIOACTIVE WASTE SOLUTIONS AND SOLIDIFICATION OF THE RESIDUE AS ALKYD RESIN. Richter, H.; Sorantin, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Strahlenschutz). Mar 1974. 24p. (In German). Dep. NTIS (US Sales Only) $4.25.

Various reagents were tested for reduction of the excess HNO_3 in radioactive waste solutions and the denitration with glycerin was studied as a function of the HNO_3 concentration, glycerin concentration, and temperature. The induction period was determined. The remaining glycerin was solidified with phthalic acid or maleic acid anhydride so that the residue was embedded at the same time. The method was tested on a sample fission product solution. Various test solids were leached with water and release rates comparable with those from bitumen-covered salt mixtures were obtained. (tr-auth)

9257 RADIOACTIVE WASTE TREATMENT SYSTEM. Mertens, J. (to Nuclear Waste Systems Co.). US Patent 3,805,959. 23 Apr 1974. Filed date 3 Jun 1971. 6p.

Radioactive waste in nuclear reactor power plants include solid radioactive process waste, floor drain wastes, and backwash water from filters and demineralizers. The solid radioactive process waste comprises filter sludges and demineralizer resins or ion exchange resins. In the radioactive waste treatment system of the present invention, the filter sludges and demineralizer resins are moved to large tanks and collected in the large tanks. The backwash water and floor drain water wastes are percolated through settled solids by gravity. In so doing, the wastes are pre-filtered and pre-demineralized. After being pre-filtered and pre-demineralized, these wastes waters are then polished in the water treatment system and returned to a condensate storage tank. (Official Gazette)

9258 RECOVERY OF RADIOACTIVE NOBLE GASES FROM GASEOUS EFFLUENTS. Dewell, E. H. (to Babcock and Wilcox Co.). US Patent 3,806,583. 23 Apr 1974. Filed date 15 Mar 1971. 6p.

A process of combating environmental pollution by separating and recovering radioactive noble gases such as xenon and krypton in a substantially pure state from the gaseous effluents of a nuclear power station is described. In the process, the gaseous effluents are initially dehalogenated and devaporized followed, in sequence, by the dehydrogenation and subsequent removal of residual gaseous contaminants from such effluents leaving the rare gases in substantially pure form for recovery. (Official Gazette)

9259 RADIOACTIVE WASTE TREATMENT AND DISPOSAL PLANT. Feher, L. (Fovarosi Kozegeszsegugyi es Jarvanyugyi Allomas, Budapest); Fenyes, G.; Tordai, G. Izotoptechnika; 17: No. 4, 177-186(Apr 1974). (In Hungarian).

Technical information about the new Hungarian waste disposal plant is presented. (auth)

9260 DESIGN OF A PLANT FOR THE CONCENTRATION OF LOW-ACTIVITY LIQUID WASTES. Patricio, G. P. Mexico City; Instituto Politecnico Nacional (1973). 84p. (In Spanish). Thesis.

A system is proposed for the processing of radioactive wastes from the Centro Nuclear de Mexico. The fundamental aspects characteristic of radioisotopes are established. A concentration procedure suitable to the probable composition of the wastes from the center is selected. A matter and heat balance is made as a basis for the calculation of the primary equipment and for the selection of the auxiliary equipment. The inversion cost and the processing cost are established in an economic study. (tr-auth)

Radioisotope Production

Refer also to abstracts 9678, 10070, 10071, 10125, 10514, 10569, and 11587.

9261 (IEA-302) RAPID PREPARATION OF FLUORINE-18 BY MEANS OF NUCLEAR RECOIL SEPARATION. Parker, W. C.; Da Silva, C. P. G.; Francis, W. H. G. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Aug 1973. 9p. Dep. NTIS (US Sales Only) $4.00.

The application of "hot atom chemistry" to the rapid preparation

of ^{18}F ($t_{1/2}$ = 109.7 min) is described. In this particular case, slurry, or paste targets, of lithium carbonate and distilled water were prepared and subjected to irradiation in the reactor thus: $^{6}Li(n,\alpha)^{3}H$ and $^{18}O(t,n)^{18}F$. Following the irradiation better than 90% of the fluorine activity produced in the above reaction is found in the water component of the target and 70% of this can be recovered with a single extraction of water. Using a dilute solution of NaOH, containing a trace quantity of fluorine carrier as NaF, yields as high as 98% can be realized. Parameters investigated included yield as a function of Li_2CO_3/H_2O target ratio, and type and temperature of extractant. The described method allows the quantitative recovery of the enriched 95% lithium carbonate and, very important, reduces the conventional separation time from 60–90 minutes to 7–15 minutes depending on the final concentration required for the preparation. Because of its short half-life, ^{18}F is favored as an isotope for brain tumor scanning. (auth)

9262 (IFA-RF-1-1974) PRODUCTION OF ^{113m}In. Development of Methods for the Analytical Control of the Chemical, Radiochemical, and Radionuclide Purity. Galateanu, I.; Zamfir, I.; Lungu, V. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 23p. (In Rumanian). Dep. NTIS (US Sales Only) $4.25.

Factors influencing the chemical, radiochemical, and radionuclide purity of ^{113m}In during its production are analyzed. Methods for determining the chemical and radiochemical purity of pharmaceuticals containing this isotope are described. Methods used for the preparation of ^{113m}In-labelled pharmaceuticals and the techniques for assuring their purity are outlined. (JSR)

9263 (RFP-2206) RECOVERY AND PURIFICATION OF AMERICIUM-241 FROM AN ALUMINUM–AMERICIUM OXIDE MIXTURE. Proctor, S. G. (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). 27 May 1974. Contract AT(29-1)-1106. 5p. Dep. NTIS $4.00.

A method for the separation and purification of americium from a mixture of aluminum and americium oxide has been developed. The precipitation procedure was designed to recover americium from gross amounts of aluminum by utilizing aluminum solubility in caustic solutions. Additional purification was obtained by successive fluoride and oxalate precipitations. The developed procedure has been used to recover and purify 57 g of americium from 204 g of aluminium–americium oxide. (auth)

9264 PLANT FOR THE PRODUCTION OF RADIOISOTOPES. Flores Espinosa, R. M. Mexico City; Instituto Politecnico Nacional (1973). 167p. (In Spanish).

Thesis.

From an analysis of the labeling isotopes most used in Mexico City, the possibilities and limitations for their production using the Triga Mark III reactor are established. Because of the development of processing techniques of radioisotopes and from an economic evaluation, an industrial plant of medium capacity for radioisotope production was constructed. The plant consists of a series of hot cells. The handling of the materials is done through the shielding with large remote-control devices. The design criteria for the control for the contamination produced by the radioactive wastes and for the control of the internal and external irradiation are formulated. From these design concepts a selection was made of the construction materials and the shielding and remote-control devices. (tr-auth)

Reactor Fuel Reprocessing

Refer also to abstracts 9457 and 9498.

9265 (AERE-M-2629) DETERMINATION OF NITRIC ACID IN TRIBUTYL PHOSPHATE/KEROSENE PHASES CONTAINING URANIUM AND THORIUM. Wain, A. G. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Apr 1974. 7p. Dep. NTIS (US Sales Only) $4.00.

Direct titration of nitric acid in organic phases containing uranium and thorium, with an organic base is described and its application to process plant solutions suggested. (auth)

9266 (BNWL-tr-115) FILTER PROGRAM. Wilhelm, J. G.; Dillmann, H. G.; Furrer, J.; Gerlach, K. (Kernforschungszentrum Karlsruhe (F.R. Germany)). May 1974. Translation of excerpt from KFK-1818. 34p. Dep. NTIS $4.75.

Progress in the filter program is reported in the following areas: development of iodine filters and adsorber materials for reprocessing facilities; breakdown-circulating air filters for precipitation of fission products from safety container atmosphere; segregation of minute iodine and methyl iodide concentrations from humid air; aging of fission iodine adsorber materials; investigations on impregnated active coal and filters for fission iodine segregation; construction of a sampling location for fission iodine from loop experiments; examination of sodium aerosols in sodium burning tests; and iodine monitor. The complete report was indexed previously and appeared as abstract 28: 21635. (LK)

9267 (DPSPU-69-30-1) EVALUATION OF CENTRIFUGAL CONTACTORS. Orth, D. A.; McKibben, J. M. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Plant). Jun 1969. Contract AT(07-2)-1. 15p. (CONF-690609-30). Dep. NTIS $4.00.

From 15th annual meeting of the American Nuclear Society; Seattle, Washington, USA (15 Jun 1969).

Centrifugal contactors were developed by Savannah River Laboratory, and a bank of 18 stages was placed in service in 1966 as the 1A bank of the Purex solvent extraction system at the Savannah River Plant. These units were installed specifically to test their capabilities in plant service. Experience during the past three years provides information on mechanical performance, control requirements, recovery efficiency, decontamination from fission products, and solvent degradation. Further, the differences in fission-product behavior in the mixer-settlers and centrifugals stimulated laboratory tests that have clarified the mechanism involved. (auth)

9268 (ORNL-TM-4488) AQUEOUS FUEL REPROCESSING QUARTERLY REPORT FOR PERIOD ENDING DECEMBER 31, 1973. Unger, W. E.; Mailen, J. C.; Irvine, A. R.; Watson, C. D. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 47p. AT.

Voloxidation of irradiated $(U,Pu)O_2$ fuel in a minature rotary voloxidizer removed up to 99.5% of the tritium in the fuel. Ruthenium was found to catalytically reduce Ce^{4+} in nitric acid; this makes the use of Ce^{4+} as a PuO_2 dissolution promotor unlikely. Fluoride still looks attractive and should cause no solubility problems with either rare earths or plutonium in any part of the processing plant. A tumbling dissolver was found to be very effective in washing simulated fuel residue from chopped cladding. Development of the Iodox process was continued with a series of runs made in a five-plate bubble-cap tower 7.6 cm in diameter. Stage decontamination factors averaged approximately 4 for CH_3I at an air rate of 56 liters/min. Laboratory studies of the chemistry of the Iodox process increased the understanding of the equilibrium and reactions involved in the iodine-nitric acid-nitrous oxide system. It was found that methyl iodide is rapidly broken down into iodine and methyl nitrate. The krypton removal pilot plant at ORGDP progressed into the initial shakedown operation stage. With minor changes and adjustments all equipment performed satisfactorily. (auth)

9269 (ORNL-TM-4560) FISSION PRODUCT GAS RETENTION PROCESS AND EQUIPMENT DESIGN STUDY. Murbach, E. W.; Carr, W. H.; Gray, J. H. III. (Allied-Gulf Nuclear Services, Barnwell, S. C. (USA)). May 1974. Subcontract 3628. 59p. AT.

For Oak Ridge National Lab., TN.

The status of fission gas retention systems of potential application to a fuel reprocessing plant has been reviewed. Two processes currently under development at Oak Ridge National Laboratory and the Oak Ridge Gaseous Diffusion Plant were evaluated to determine their applicability to the Barnwell Nuclear Fuel Plant. These processes are fluorocarbon absorption for krypton recovery and voloxidation for tritium recovery. Flowsheets for adaptation of these processes to the BNFP were developed and cost estimates prepared for installation of the facilities. The estimates were $\$5 \times 10^6$ for krypton recovery and $\$34 \times 10^6$ for tritium recovery. These costs are exclusive of storage charges. Neither process is sufficiently developed at this time for commercial reprocessing plant installation. (auth)

9270 (RFP-Trans-158) STUDY ON THE FURTHER TREATMENT OF SPENT FUEL ELEMENTS FROM THORIUM HIGH-TEMPERATURE REACTORS WITH SPHERICAL FUEL ELEMENTS. Jauer, H.; Laser, M.; Merz, E.; Storch, S.; Tillessen, U. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany)). Apr 1973. Translation of JUL-943-CT. 44p. Dep. NTIS $5.25.

The study of the further treatment of spent fuel elements from thorium high-temperature reactors is concerned mainly with further treatment of the fuel elements from the THTR-300 prototype nuclear power station. In addition, the outlook is examined for the consequences of extrapolating up to 5000-MWe power station capacity with spherical pile reactors. The alternatives discussed comprise: reprocessing in the WAK or a commercial plant, final storage of the heavy metal particles freed from graphite in the consolidated state, final storage of the whole fuel elements. For further processing of the THTR-300 fuel elements, it is recommended that when uranium is to be reused, these be worked up after intermediate storage in the commercial plants which will be erected. As a temporary solution, it seems conceivable from purely nuclear technology aspects that the fuel elements could first be finally stored in the Asse. However, the administrative,

mining and technical safety conditions for this could not be conclusively clarified in the scope of this study. However, as was first shown in the course of the investigations (and this must be taken as an essential result of the study) final disposal of larger amounts of irradiated nuclear fuels containing fissile material in the Asse cannot be approved. Before a final decision can be made on deposition, there needs to be detailed experimental investigations on the secular safety of the various fissile-containing products as well as a longer experimental and observation phase with a limited number of fuel elements arriving for experimental deposition. Moreover, this experimental deposition should be developed so as to be "returnable." The fuel elements of other spherical pile reactors are worked up in a commercial reprocessing plant after intermediate storage. (auth)

9271 (Y-1452) URANIUM RECOVERY FROM ROVER FUEL ELEMENTS. Laggis, E. G. (Oak Ridge Y-12 Plant, Tenn. (USA)). 10 Jan 1964. Contract W-7405-eng-26. 25p. Dep. NTIS $4.25.

A process was developed at Y-12 for recovering uranium from NbC-lined Rover fuel elements. This process is based on the finding that NbC is readily soluble in a cold mixture of HF and HNO_3. The minimum composition limits of the delining leachate were determined to be 3.2 M HNO_3 and a HF to Nb mole ratio of 10 : 1. The hydrogen fluoride concentration controlled the reaction rate in the range studied (0.5 M to 19 M). Total uranium recovery was essentially effected by burning the delined element and dissolving the ash in nitric acid. Hydrogen peroxide added to the deliner leachate at H_2O_2-to-Nb mole ratios of 4 : 1 to 10 : 1 prevent niobium precipitation in the presence of the aluminum ion. Solution stability was maintained for 15 days and previous precipitates were dissolved. Uranium was extracted from the generated solutions using dibutyl-Carbitol (DBC) and tributyl phosphate (TBP). Uranium–niobium separation factors of 11,000 to 20,000 were achieved in 33% TBP-Amsco extraction tests. A proposed deline-burn process has also been devised with three alternates for integrating the delined leachate into the existing uranium slavage facilities. There are certain merits for mechanically removing NbC liners from fuel elements with subsequent processing. (auth)

9272 WASTE GAS TREATMENT IN THE CHLORINATION REPROCESSING OF GRAPHITIC FUEL AND BREEDER ELEMENTS FROM HIGH-TEMPERATURE REACTORS. Barnert-Wiemer, H. Aachen; Technische Hochschule (1971). 91p. (In German).

Thesis.

A gas mixture of chlorine, silicon tetrachloride, carbon monoxide, phosgene and fission noble gases was yielded in the high-temperature chlorination of silicon carbide-containing thorium high-temperature fuel elements. Chlorine is separated from this mixture and for economical reasons recycled. The chlorine must be free of oxygen and carbon dioxide as these substances corrode the graphite components of the chlorination reactor. In order to achieve this, a physical and chemical purification process was developed. A decision for the process to be used depends greatly on the special requirements. Important criteria are plant size, safety aspects and especially the question of possible emission of residual gases such as krypton-85. A process to destroy waste gas has been developed for a small experimental plant to be included in the hot cells. Silicon tetrachloride is oxydized again to SiO_2 and separated off. For shortly cooled fuel elements, an iodine separation is recommended. As the radioactivity is partly present as iodine aerosols, one can achieve decontamination factors of some 2,000 by steam condensation. The residual gas is led into a sodium hydroxide solution where chlorine and CO_2 are absorbed. The noble gases can be emitted at the moment through sufficiently high chimneys. (GE)

9273 METHOD FOR REPROCESSING RADIOACTIVE MATERIALS. Kaiser, G.; Merz, E.; Riedel, H. J. (to Kernforschungsanlage Juelich Gesellschaft mit Beschranker Haftung). US Patent 3,808,320. 30 Apr 1974. Priority date 27 May 1969, F.R. Germany. 10p.

A process is described for recovering uranium, thorium, and like materials from fission products of nuclear fuels and breeder elements, wherein the mixture of uranium, thorium, protactinium, and fission products is introduced preferably as oxides or mixed oxides, into a fused inorganic pyrosulfate melt and dissolved therein. The pyrosulfate melt is dissolved in water and treated to precipitate thorium as the sulfato-thorate whereupon the liquid phase is treated by tributylphosphate extraction to recover the uranium. Prior to precipitating this sulfato-thorate, the aqueous solution is passed through an absorption column to recover protactinium. (Official Gazette)

9274 ROLE OF RADIOCHEMISTRY IN NUCLEAR ENERGY. Toth, B. Izotoptechnika; 17: No. 4, 200-208(Apr 1974). (In Hungarian).

Chemistry of the reprocessing of fuel elements is discussed. The organic solvent extraction in the Redox and Purex Processes is considered. (auth)

9275 SEPARATION OF RADIOACTIVE KRYPTON AND XENON FROM THE GASEOUS WASTES OF NUCLEAR PLANTS. Wojir, F. (Oesterreichische Studiengesellschaft fuer Atomenergie GmbH, Seibersdorf); Schoenfeld, T. Allg. Prakt. Chem.; 24: No. 3/4, 51-63(Mar 1973). (In German).

The problems raised by the production of radioactive krypton and xenon isotopes in nuclear plants are discussed in this review. Important amounts of these gases are set free in reprocessing plants, in particular the long-lived isotope ^{85}Kr. Conditions are discussed under which the separation of radioactive krypton and xenon from gaseous wastes is expected to be necessary. The main known separation procedures for rare gases are reviewed, in particular: adsorption on activated carbon or molecular sieves; separation by distillation at low temperatures; solvent adsorption; and diffusion through membranes with selective permeability. The storage techniques for the cited gases are likewise reviewed. Finally, available data about the ^{85}Kr emission by nuclear plants and resulting uptake by man are discussed, as well as related safety problems. (INIS)

9276 EUROCHEMIC EXPERIENCE. Detilleux, E. J. Atoomenerg. Haar Toepass.; 16: No. 3, 57-61(Mar 1974). (In Dutch).

The activities and experience of the Eurochemic organization are reviewed since it was first set up, under the auspices of OECD, in July 1959. Studies of nuclear materials, including fuel reprocessing, are reported in some detail. A future programme, extending these studies, is also outlined. (NL)

CONTROLLED THERMONUCLEAR RESEARCH

9277 PLASMA PHYSICS INDEX. Volume 9, No. 4, 1974. Bibliography, Author Index, Subject Index. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 144p.

Confinement and Heating

Refer also to abstracts 9308 and 9335.

9278 (COO-2180-2) MEASUREMENTS ON A SPHERICAL ELECTROSTATIC CONFINEMENT SYSTEM EMPLOYING SIX ION GUNS. Gardner, A. L.; Hatch, D. M.; Chan, A. I. Y.; Evans, R. P. (Brigham Young Univ., Provo, Utah (USA)). 4 Mar 1974. Contract AT(11-1)-2180. 18p. (CONF-740316-5). Dep. NTIS $4.00.

From conference on electrostatic and electromagnetic confinement of plasmas and the phenomenology of relativistic electron beams; New York, New York, USA (4 Mar 1974).

A spherical electrostatic confinement system using ion injection from six ion guns was studied with microwave cavity techniques to measure the electron density with the confinement volume. (MOW)

9279 (COO-2180-4) STUDIES OF CHARGED-PARTICLE DISTRIBUTIONS IN AN ELECTROSTATIC CONFINEMENT SYSTEM. Progress Report, August 1, 1972–March 31, 1974. Gardner, A. L. (Brigham Young Univ., Provo, Utah (USA). Dept. of Physics and Astronomy). 1974. Contract AT(11-1)-2180. 10p. Dep. NTIS $4.00.

The spherical electrostatic confinement device employing six ion guns was operated with differentially pumped ion guns and with the high voltage switched at rates of 5 and 10 Hz to permit "continuous" measurements of two microwave cavity modes for determination of the electron density in the interior. In measurements down to 0.4 millitorr (deuterium) the effect of the background gas dominates in its contribution to the measured electron density. At ~10 GHz the threshold detection sensitivity was equivalent to that of a uniform electron density of 5×10^6 electrons/cm^3. However, the use of shorter wavelengths to obtain meaningful spatial resolution was considered impractical because of the low densities observed. The comparison of electron densities achieved with individual ion beams is found to be a powerful technique and it is planned to use this method at ~2 GHz to measure the extent of cooperative effects that occur when the six beams are simultaneously present. Similar measurements are also planned with the neutron yield. (auth)

9280 (COO-3086-28) NUMERICAL SIMULATION OF SHOCK-HEATED PLASMA WITH A MAGNETIC DAM. Todd, A. M. M. (Columbia Univ., New York (USA). Plasma Lab.). 1974. 135p. Dep. NTIS $9.75.

Thesis.

A numerical code was developed to solve the interaction of an ideal high-beta coaxial shock tube plasma with a pinching magnetic field generated by an external cusp coil. The effectiveness of this system in damming the hot shock and end wall reflection-heated plasma at the end of the shock tube was examined. The plasma dynamics were solved using a generalized two-dimensional axisymmetric version of Marder's GAP Code, with boundary conditions of perpendicular wall velocity zero and total interface pressure continuous. The cusp vacuum was solved using an overrelaxation scheme on the Laplace vector potential equation with a boundary condition of perpendicular magnetic field zero. The results obtained show that within the limits of the ideal MHD model used, the cusp coil can be effective in damming the initial plasma expansion, and that the proposed parameters for Columbia's coaxial shock tube should be adequate to obtain this end. A one-dimensional analysis is presented which may be used to conservatively predict the cusp coil parameters required for such containment, given filling gas and drive parameters. The success of the code in the solution of this problem suggests that since it is easily adaptable, it may be used on other problems involving the interaction of ideal MHD plasmas with external magnetic fields. (auth)

9281 (IPP-3-8) RF-PLASMA HEATING WITH L-STRUCTURES. Lisitano, G.; Corti, S.; Bergbauer, M.; Capitanio, A.; van Heumen, A.; Reiter, A.; Rossetti, E. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). May 1973. 28p. INIS.

Rf wave-launching structures (L-coils) were excited in a stellarator and in a magnetic mirror machine. The characteristics of the discharge are presented. They cannot be explained by known wave-plasma interactions except by rf turbulence heating. (GE)

9282 (IPP-6-122) TURBULENT HEATING AND QUENCHING OF ION SOUND INSTABILITY. Dum, C. T.; Chodura, R.; Biskamp, D. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jan 1974. 16p. (IPP-1-142). Dep. NTIS (US Sales Only) $4.00.

Turbulent heating and stabilization of the ion acoustic instability was investigated by 2 D computer simulation. Quasilinear rather than nonlinear effects determine the evolution of the instability. The growth rate is reduced by flattening of the electron distribution and finally the instability is quenched by the formation of a high energy ion tail. (auth)

9283 (MATT-1033) EFFECTS OF BEAM-PLASMA THERMONUCLEAR REACTIONS DURING ION-BEAM HEATING TO IGNITION. Jassby, D. L.; Furth, H. P. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Mar 1974. Contract AT(11-1)-3073. 7p. Dep. NTIS $4.00.

If a 1:1 D–T tokamak plasma is heated to ignition by D beams with injected energy in the range 150 to 300 keV, the total energy of fusion products formed by reactions between beam deuterons and plasma tritons is 0.33 to 0.90 times the total injected beam energy, depending on the ignition temperature. Plasma heating by the alphas generated by these reactions reduces the total required injected neutral-beam capacity by as much as 18%. (auth)

9284 (MATT-Trans-109) BASIC FACTORS DEFINING THE BEHAVIOR OF AN IMPURITY IN A TOKAMAK PLASMA. Gervids, V. I.; Krupin, V. A. 1973. Translated from Russian. 38p. Dep. NTIS $5.00.

A study is made of the behavior of a carbon impurity in a plasma. The dependence of the electron temperature T_e and the electron density n_e on the distance to the axis of the plasma column r and the time t, the diffusion of the impurity ions, and the influx of a neutral impurity into the plasma from outside during the discharge process are considered. The following facts are demonstrated: (a) the essential nature of the effect of gradual growth of n_e and T_e and the nonuniformity of their distribution with respect to the cross section of the plasma column on the concentration and intensity of radiation of the impurity ions; (b) there is a significant increase in the impurity concentration during the discharge time; and (c) there is a clear diffusion of impurity ions toward the axis of the plasma column. Estimates are obtained for the increase in concentration of the carbon impurity during the discharge time, the local values of the densities of the diffusion fluxes of carbon ions and of the absolute carbon concentration. (auth)

9285 (NP-20000) STOCHASTIC HEATING OF PLASMA DURING GROWTH OF INSTABILITIES IN LANGMUIR TURBULENCE. Khakimov, F. Kh.; Tsytovich, V. N. (AN SSSR, Moscow. Fizicheskij Inst.). 1972. 23p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The nonlinear theory of the absorption of Langmuir oscillations in the regime of the growth of Langmuir turbulence was developed. The spectra of the strong turbulence of low-frequency pulsations, excited by the Langmuir turbulence, were found. The heating of the electrons, effected by the low-frequency oscillations, generated by the Langmuir turbulence, was evaluated. The calculations were made under the assumption of the one-dimensionality of the motion (magnetization) of the electrons. (tr-auth)

9286 (NP-20002) ROLE OF COLLISIONS IN ELECTROMAGNETIC WAVE ABSORPTION AT FREQUENCIES NEAR THE LOWER HYBRID RESONANCE. Galaktionov, B. V.; D'yachenko, V. V.; Larionov, M. M.; Shcherbinin, O. N. (AN SSSR, Leningrad. Fiziko-Tekhnicheskij Inst.). 1973. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Some experiments on the localization of hf absorption, made on the Tokamak FT-I device in the low temperature regime at the frequencies near lower hybrid resonance, are described. The role of the collision absorption of the slowed electromagnetic wave is analyzed. Calculations of the real and imaginary parts of the transverse refractive index are given for $\nu/\omega = 0.01$. The high efficiency of the collision absorption in the vicinity of the lower hybrid frequency in the experimental condition is discussed. (auth)

9287 (NP-20006) PARAMETRIC HEATING OF ELECTRONS IN MAGNETIZED PLASMA. Andreev, N. E.; Batanov, G. M.; Sarksyan, K. A. (AN SSSR, Moscow. Fizicheskij Inst.). 1973. 11p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

New data are reported on the distribution function of anomalously heated electrons during the interaction of superhigh

frequency pumping with magnetized plasma. The increase of the transverse (relative to the external magnetic field) energy of the electrons in the presence of a strong superhigh frequency field was also discussed. The connection of the observed effects with the excitation of parametric instability was considered. (tr-auth)

9288 (NP-20007) SUPERHIGH FREQUENCY METHOD FOR HEATING ELECTRONS IN THE TOR-1 STELLERATOR. Akulina, D. K.; Andryukhina, Z. D.; Smirnova, A. D.; Khol'nov, Yu. V. (AN SSSR, Moscow. Fizicheskij Inst.). 1973. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A resistance superhigh frequency method for heating electrons of a laser plasma was investigated. The mechanism limiting the electron temperature was examined. The dependence of the lifetime of the plasma on the temperature was determined. The non-correspondence with classical mechanisms calculated for colliding plasma is shown. (tr-auth)

9289 (ORNL-TM-4585) ENERGY CONTAINMENT AND SCALING IN TOKAMAKS: (THE PHYLOGONY OF A TOKAMAK DISCHARGE). Clarke, J. F. (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W-7405-eng-26. 55p. (CONF-731009-8). Dep. NTIS $5.75.

From annual plasma physics meeting of the American Physical Society; Philadelphia, Pennsylvania, USA (31 Oct 1973).

The electron energy balance in tokamaks was studied. It is shown that the qualitative dependence of electron energy containment on plasma parameters is a result of microscopic energy transfer by a diffusion process which can be characterized by the pseudoclassical diffusion coefficient. Ion energy balance is discussed and it is shown that ion energy containment in tokamaks is the result of a balance between electron heating and the loss processes of charge exchange, particle diffusion, and neoclassical ion thermal conductivity. (MOW)

9290 (SLA-74-5252) THERMONUCLEAR REACTIONS IN SOILD SPHERICAL LASER TARGETS. Clauser, M. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 20p. (CONF-740439-1). Dep. NTIS $4.00.

From 7th European conference on plasma production by high power lasers; Garching, F. R. Germany (22 Apr 1974).

The behavior of spherical targets irradiated by simple unshaped laser pulses was investigated. It was found that the neutron production is strongly dependent on the sphere diameter and the laser pulse length, as well as the absorbed energy. In the spherical targets the dominant mechanisms for ion heating are compression by a spherically converging shock wave and subsonic compression caused by the high electron pressure in the outer portion of the sphere, as well as by equilibration with hot electrons. For fixed sphere diameter and laser pulse length one finds that the neutron production can increase as rapidly as the fifth power of the absorbed energy. However, these curves inevitably level off and start decreasing as the energy is increased further. The optimum sphere diameter and the optimum pulse length are both weakly dependent on the amount of absorbed laser energy. At these optimum values the neutron production varies approximately as the 1.6 power of the absorbed energy. (MOW)

9291 (UCRL-75465) SUPERTHERMAL ELECTRON DISTRIBUTIONS IN LASER-PRODUCED PLASMAS. Shay, H. D.; Bailey, D.; Bodner, S.; Katz, J.; Kruer, W.; Nuckolls, J.; Slivinsky, W.; Valeo, E.; Zimmerman, G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Apr 1974. 24p. (CONF-740439-2). Dep. NTIS $4.25.

From 7th Euroepan conference on plasma production by high power lasers; Garching, F. R. Germany (22 Apr 1974).

A review of the program at LLL to determine the heating of superthermal electrons during the irradiation of CD_2 targets at the Long Path Laser Facility is presented. The review covers plasma simulation work with the hydrodynamic code LASNEX along with some experimental results. (MOW)

9292 CO_2-LASER-BEAM ABSORPTION BY A DENSE PLASMA. Fabre, E.; Stenz, C. (Laboratoire de Physique des Milieux Ionisés, Ecole Polytechnique, Paris, France). Phys. Rev. Lett. 32: No. 15, 823-826 (15 Apr 1974).

We study the absorption of a CO_2-laser beam by an independently produced plasma at approximately the critical density. The measured fractional absorption coefficient agrees with that associated with inverse bremsstrahlung for incident laser intensities below 10^{10} W/cm^2. Above this value, an abrupt increase in absorption is observed. (auth)

9293 PLASMA HEATING BY INTENSE, RELATIVISTIC ELECTRON BEAMS. Goldenbaum, G.C.; Dove, W.F.; Gerber, K.A.; Logan, B.G. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Rev. Lett. 32: No. 15, 830-833 (15 Apr 1974).

A partially ionized helium plasma ($n_e = 5\times10^{13}$ cm^{-3}) was heated by an intense ($v/v_{Te} \gtrsim 1$) relativistic electron beam (600keV, 25-60 kA). Observations of the emitted line radiation and Thompson-scattered light indicate noncollisional electron heating rates consistent with electron-ion instability predictions, and total energy deposition consistent with electron-electron-instability saturation levels. (auth)

9294 INTERPRETATION OF TRANSIT TIME MAGNETIC PUMPING FROM THE POINT OF VIEW OF THE MACROSCOPIC PLASMA EQUATIONS. Brambilla, M. (CEN, Grenoble, France). Plasma Phys.; 16: No. 5, 482-485(May 1974).

Confusion exists in the literature about the interpretation of plasma heating by Transit Time Magnetic Pumping (TTMP) in terms of macroscopic quantities. Evaluation of the power absorption as the time average of J. E. using the dielectric description of a hot plasma leads to contradictory results. For instance an expression derived by Stix and Lashmore-Davies for a uniform plasma becomes negative (the plasma appears to cool down) when an evanescent wave (with $k_\perp^2 < 0$) is considered, as appropriate to most experimental conditions. The reason why this approach runs into difficulties is that it disregards the fact that at TTMP frequencies, and as long as collisional effects are negligible, the plasma is frozen to the lines of force. On the other hand, as the moments of any solution of the Vlasov-Boltzman equation satisfy the well-known macroscopic equations, it must be possible to discuss the power absorption by Transit Time in terms of the macroscopic equations entering in these equations. It was shown that the correct macroscopic expression included dissipation of work done by the pressure forces and led to the same value for the local power absorption as the usual macroscopic approach which consists in averaging over the particle distribution function the rate of energy gain by a single particle. (UK)

9295 EFFECT OF INJECTION FUEL ENERGY ON FUSION-REACTOR STABILITY AND FEEDBACK CONTROL. Fujisawa, T. (Princeton Univ., NJ). Nucl. Fusion; 14: No. 2, 173-183(Apr 1974).

The effect of injection fuel energy on the plasma dynamics stability of a stationary fusion reactor was investigated, using a mathematical model based on the energy density and particle density balance of four plasma constituents. For this purpose, numerical calculations of eigenvalues were made after the linearization of a set of plasma equations. The result suggests that a neutral-beam injection gun of moderate energy favors, from the point of view of dynamics, the realization of a stable plasma rather than a pellet injection method of very low energy. Further calculations were made to study the inner mechanism of thermal instability of a plasma. Finally, a feasible way of plasma stabilization by feedback control was examined. (auth)

9296 EFFECTS OF NEUTRAL INJECTION HEATING UPON TOROIDAL EQUILIBRIA. Connor, J. W.; Gordey, J. G. (Culham Labs., Abingdon, Eng.). Nucl. Fusion; 14: No. 2, 185-190(Apr 1974).

Effects of neutral beam injection upon the equilibrium of a toroidal plasma are considered. The distribution function of energetic ions produced by the beam in the plasma is calculated for injection both parallel and perpendicular to the magnetic field taking account of effects due to the toroidal geometry. The effect of trapped particles on the current induced in the plasma by such a beam is calculated, together with the associated cross-field diffusion. Loss mechanisms for the momentum deposited in the plasma by the neutral beam are considered. Ripples in the toroidal magnetic field strength are particularly efficient at destroying toroidal momentum and lead to flow velocities much less than the sound speed for typical injection parameters. (auth)

9297 TURBULENT HEATING OF IONS OF A NON-ISOTHERMAL PLASMA BY THE ELECTRON-SOUND INSTABILITY. Demchenko, V. V.; Hussein, A. M. (Atomic Energy Authority, Cairo). Nucl. Fusion; 14: No. 2, 237-249(Apr 1974).

Turbulent heating of ions of a nonisothermal plasma by the kinetic electron-sound instability is investigated. The heating of ions exposed to the electron-sound instability is caused by a quasi-linear heating mechanism. The ion temperature rises owing to the absorption of the unstable-oscillation energy by ions under the conditions of Cherenkov resonance. The heating time under the electron-sound instability is estimated. (auth)

9298 STOCHASTIC HEATING OF ELECTRONS AND IONS IN AN ISOTHERMAL PLASMA BY HYDRODYNAMIC CURRENT INSTABILITY. Demchenko, V. V.; Hussein, A. M. (Atomic Energy Authority, Cairo). Nucl. Fusion; 14: No. 2, 229-235(Apr 1974).

Turbulent heating of electrons and ions by a collisionless shock wave propagating in a plasma across the magnetic field is investigated. Plasma heating in isothermal plasma occurs as a result of the development of hydrodynamic current instabilities. Heating of

plasma subject to hydrodynamic current instabilities is caused by a stochastic mechanism. The temperature variation of the plasma particles at the shock front as well as an estimate of the heating time are obtained. The estimates agree well with the known experimental data. (auth)

9299 CONFINEMENT OF CHARGED PARTICLES IN ADIABATIC TRAPS IN THE PRESENCE OF MONOCHROMATIC CYCLOTRON OSCILLATIONS. Timofeev, A. V. (Inst. of Atomic Energy, Moscow). Nucl. Fusion; 14: No. 2, 165-171(Apr 1974).

The conditions under which cyclotron oscillations randomize the motion of charged particles in an adiabatic trap are described. When the amplitude of the cyclotron wave is considerable, the randomization is due to the resonance of the longitudinal oscillations between the magnetic mirrors with transverse oscillations in the cyclotron wave field. If the amplitude is moderate, then the effect is due to phase shift at the resonance point. It is demonstrated that in the latter case the loss of particles from the trap may be insignificant, provided the oscillations have a short wavelength and the plasma is collisionless. (auth)

9300 NEUTRAL-BEAM INJECTION INTO A TOKAMAK. Part I. Fast-Ion Spatial Distribution for Tangential Injection. Rome, J. A.; Collen, J. D.; Clarke, J. F. (Oak Ridge National Lab., TN). Nucl. Fusion; 14: No. 2, 141-157(Apr 1974).

The production processes and spatial distribution of fast ions resulting from tangential injection of a diffuse neutral beam into a tokamak are discussed. The spatial distribution of fast ions for various injection trajectories and absorption mean free paths are calculated and discussed in detail. Maximum beam absorption for a parabolic density profile is shown to occur for injection roughly halfway between the inner wall of the torus and the magnetic axis; however, since this maximum is near unity and only weakly dependent on the injection trajectory, this is not the most important possible optimization. Since the drift orbit surface area over which the fast ions are distributed is roughly proportional to the distance from the magnetic axis, the fast ion density is found to be strongly peaked at the magnetic axis for present experiments where the absorption mean free path λ is comparable to the plasma radius a. This geometric peaking effect is strong enough to overcome the exponential beam attenuation and cause the fast-ion density and consequent beam energy deposition to be peaked at the plasma center as long as $\lambda_0 \gtrsim a/4$. Charge exchange of the fast ions with neutrals in the plasma can deplete the fast-ion population, particularly near the plasma edge. When charge exchange is an important loss mechanism, beam injection nearly tangent to the magnetic axis is found to maximize the beam effectiveness in heating. (auth)

9301 EFFECTS OF GLOW-DISCHARGE CLEANING ON JOULE HEATING IN HELIOTRON-D. Sasaki, A.; Obiki, T.; Koyama, M.; Sato, I.; Ohtake, I.; Iiyoshi, A.; Uo, K. (Kyoto Univ., Uji, Japan). Nucl. Fusion; 14: No. 2, 287-289(Apr 1974).

A schematic diagram of the Heliotron-D pumping system is given. The glow discharge cleaning method was applied in the following manner: after evacuation to a pressure less than 5×10^{-7} torr, helium gas is introduced up to 7×10^{-2} torr. Then a potential of 800 to 1000 V ac is applied between the vacuum vessel and the helical conductor with a discharge current of 1.5 A ac. The discharge is dynamically evacuated by the mechanical booster pump with a gas flow rate of about 5 torr liter/sec. The effects of the cleaning on Joule heating were examined. Mass spectra are shown. (MOW)

9302 PLASMA HEATING BY ALFVÉN-WAVE PHASE MIXING. Hasegawa, A.; Chen, L. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. Lett. 32: No. 9, 454-456 (4 Mar 1974).

We propose the heating of collisionless plasma by utilizing a spatial phase mixing by shear Alfvén wave resonance and discuss the application to toroidal plasma. The phase mixing takes place as a result of the nonuniform Alfvén speed. The approximate heating rate per cycle of the wave frequency is given by $(b_0^2/\mu_0)\,\kappa/k_\perp$, where κ is the measure of the nonuniformity, $k_\perp$ is the wave number perpendicular to the direction of the magnetic field and the nonuniformity, and b_0 is the flux density of the applied-wave magnetic field. (auth)

Diagnostics

Refer also to abstracts 9278 and 10849.

9303 (AD-771194) X-RAY AND NEUTRON PRODUCTION OPTIMIZATION IN THE DENSE PLASMA FOCUS. Final Report, June 1, 1971–July 31, 1972. Peacock, N. J. (UKAEA Research Group, Abingdon. Culham Lab.). Nov 1973. Contract F44620-71-C-0098. 64p. (AFWL-TR-73-147). NTIS $3.50.

Parameters of the plasma focus experimental assembly at Culham, England, a coaxial gun type first described by Mather, was evaluated using advanced laser diagnostic techniques. The measurements have resulted in a more nearly complete appreciation of the formation, duration, and breakup of the dense pinch phase of the focus. (auth)

9304 (COO-2180-3) INSTRUMENTATION FOR CONTINUOUSLY RECORDING PLASMA-INDUCED FREQUENCY SHIFTS OF TWO MICROWAVE CAVITY RESONANCES. Evans, R. P. (Brigham Young Univ., Provo, Utah (USA)). Apr 1974. Contract AT(11-1)-2180. 61p. Dep. NTIS $6.25.

Thesis.

Instrumentation was developed for the continuous recording of the frequency shifts of two resonances of a spherical microwave cavity. These changes in the resonant frequency are caused by the presence of a plasma in an electrostatic confinement system. To detect the frequency shifts, a digitally controlled sample-hold circuit is employed which senses the resonances of the cavity in the two states, "plasma" and "no plasma". The two states are controlled by high voltage, applied to the inner sphere of the confinement system, which is line-synchronously switched on and off with a vacuum switch. Tests of the system, with quiet operation, show that shifts of the order of two parts in 10^6 can be detected by this method. (auth)

9305 (SC-TM-67-587) ELECTROSTATIC GRIDDED PROBE EXPERIMENTS IN A COAXIAL RAIL GUN PLASMA PULSE. Schellenbaum, R. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jul 1967. 31p. Dep. NTIS $4.75.

An electrostatic gridded probe was employed in the gold plasma pulse from a coaxial rail gun for purposes of producing a pure ion beam (with neutrals) by electron removal (stripping) and to perform particle property analyses of the beam by particle deceleration (stopping). Stripping was accomplished at a plasma density of 3.4×10^{8} cm^{-3}, 20-keV energy, and 1.4×10^{7} cm/sec velocity with ~100 volts grid bias and in fair agreement with predicted values from coulomb force considerations. Stopping analyses were made at lower plasma energies with attainable grid potentials. Approximately 1-keV carbon and approximately 4.8-keV gold ions were identified in the first and second peaks, respectively, of the typically double-peaked plasma pulse, assuming single ionization. Probe conditions of operation are discussed. (auth)

9306 ION AND ELECTRON PARAMETERS MEASURED WITH COOLED PLANE ELECTROSTATIC PROBES IN A CESIUM PLASMA. Michel, C.; Kornmann, M.; Braun, J.C. (Laboratoire de Physique des Milieux Ionisés, Université Nancy, I, Case Officielle 140, 54037 Nancy Cedex, France). J. Appl. Phys. 45: No. 6, 2457-2462 (June 1974).

To control the collector temperature of an electrostatic probe, we have studied and built a cooling circuit to cool by convection; we have considered two possibilities for the cooling liquid—with and without phase conversion. We give the corresponding thermic study and the cooling effects on the experimental results, obtained from a simple Langmuir probe and a grid probe. The cooling is indispensable at all temperatures for a probe with a positively biased grid. We find that the remission current varies when the collector is still negative. (auth)

9307 ELECTRON DISTRIBUTION IN A GRIDDED PENNING DISCHARGE. Conte, D. (Naval Research Laboratory, Washington, D.C. 20390); Kent, G. J. Appl. Phys. 45: No. 6, 2782-2784 (June 1974).

Electron distributions in a Penning discharge, consisting of two glow discharges separated by a cylindrical microwave cavity with gridded ends, were measured using the shift of resonant microwave frequencies and Langmuir probe data. The shape and magnitude of the distributions were determined for a range of pressure, discharge current, magnetic field, and for several cathode shapes. The microwave technique gives the distribution as a two-parameter function, and the probe data gives a more detailed profile but quantitatively less reliable. All data indicated that the plasmas were electron rich. The distributions were azimuthally symmetric with a maximum at the center at higher pressures; at lower pressures and higher magnetic fields, the densities were depressed in the center, indicating the development of a circulating sheath of electrons. The data indicates that the microwave diagnostic technique is quite suitable when the distribution is a maximum at the center, and it is a useful procedure for calibrating a probe when there is no suitable probe theory for a particular range of experimental parameters. (auth)

9308 MEASURING ROTATIONALLY SYMMETRIC POTENTIAL PROFILES WITH AN ELECTRON-BEAM PROBE. Black, W.M. (Physics Department, George Mason University, Fairfax, Virginia 22030); Robinson, J.W. J. Appl. Phys. 45: No. 6, 2497-2501 (June 1974).

An electron-beam probe has been developed to measure the potential profile of a plasma within a spherical grid structure which was designed to trap charged particles. The potential was obtained from observed deflections of a collimated beam of electrons incident upon the device at selected impact parameters. The beam consisted of conversion electrons of 62.2 and 84.2 keV from a Cd_{109} source. Deflections of the beam through the plasma were measured relative to the beam trajectory without voltage applied to the grids. A movable detector allowed angular resolution to within 0.08 deg for maximum deflections of 7 deg. The inversion of the nonlinear singular integral relating potential and deflection is accomplished in an iterative manner with appropriate series expansions about the singular points. Simulations using postulated potential profiles show this procedure to give accuracy typically better than 4% with 20 deflection samples. Beam deflection measurements in spherical electrostatic systems without plasma show this probe technique to be very accurate. For a variety of experimentally controlled plasma parameters, no measurable departures from electrostatic potential profiles were observed. (auth)

9309 PROBE CHARACTERISTICS FOR AN ANISOTROPIC ENERGY DISTRIBUTION. Lukovnikov, A.I. (Moscow Engineering Physics Institute). Sov. Phys.–Tech. Phys. 18: No. 7, 936-939 (Jan 1974).

The current density and second derivative of the current with respect to the potential are derived for an anisotropic energy distribution in the thin-sheath approximation for cylindrical and plane probes. The results found with two-sided cylindrical and plane probes under similar conditions cannot be interpreted unambiguously. It is suggested that "shadowed" and asymmetric probes be used to monitor the anisotropy. (auth)

Kinetics (General)

9310 (IPP-IV-64) PLASMA CAPACITOR WITH ION ACOUSTIC WAVES. Leuterer, F. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jan 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

The rf potential within a capacitor, filled with a homogeneous plasma in a magnetic field and driven at frequencies $\omega_{ci} < \omega < 4\omega_{ci}$, was examined. The ions are assumed to be cold, and the electrons to have a Maxwellian velocity distribution along the magnetic field, but zero radius of gyration. Thus, ion acoustic waves are included. The whole k_z-spectrum of the exciter is needed to explain the experimental results. (auth)

9311 (LA-5466-MS) VACUUM ULTRAVIOLET EMISSION FROM A NEON-SEEDED THETA PINCH. Thomson, D. B.; Bailey, A. G.; Engleman, R. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). Mar 1974. Contract W-7405-eng-36. 19p. Dep. NTIS $4.00.

Plasma properties and line radiation were observed with a high-density θ pinch filled with a few torr of deuterium or helium, seeded with several percent neon. The θ pinch, driven by a 60-kV, 180-kJ capacitor bank, achieves 90 kG, within a 3-μsec quarter period, in a 25-cm-long, 8.2-cm-i.d. θ coil. The predominant emission is in the 50- to 200-Å vacuum ultraviolet range. Most of the strong lines of Ne VI, Ne VII, and Ne VIII identified by others were observed on SWR or SC-7 film with a 2.2-m vacuum grazing incidence spectrograph. Radial-view spectra taken through a radial hole at the center of the θ coil indicate a more homogeneous plasma temperature than those spectra taken axially. The He II 4686-Å line profile and nearby continuum were observed with a monochromator and photomultiplier, compared with theoretical calculations, and used to obtain electron temperature and density values. A typical case for He + 2% Ne at about 1 torr yields ~40 eV at $\sim 6 \times 10^{17}$ e/cm^3. This plasma was observed by laser holography and exhibits excellent containment for about 1.0 μsec—the time of the line-profile measurements—but is followed immediately by apparently severe instabilities. A goal for follow-on experiments is to refine the temperature measurements and to observe the continuum underlying the strong neon lines so that tests can be performed on computational models used for opacity calculations. (auth)

9312 (NP-20017) WILLS PLASMA PHYSICS DEPARTMENT TWENTY-SIXTH SIX-MONTHLY PROGRESS REPORT, 1 JULY–31 DECEMBER 1973. (Sydney Univ. (Australia). School of Physics). 1973. 9p. (PR-26). Dep. NTIS (US Sales Only) $4.00.

Summaries of plasma physics research at the Sydney University School of Physics are given for the following: (1) plasma sources, (2) hydromagnetic shock waves, (3) rotating plasmas, (4) ion cyclotron work, and (5) far-infrared region. (MOW)

9313 *PLASMA PHYSICS RESEARCH FOR ENGINEERING* APPLICATIONS. Niemeijer, L.; Ragaller, K. (Brown, Boveri and Co. Ltd., Baden (Switzerland)). Polytech. Tijdschr. Elektrotech. Elektron.; 29: No. 5, 145-146(6 Mar 1974). (In Dutch).

Experiments in plasma-gas-dynamics currently in progress at Brown Boveri Laboratories are summarized. In a typical experiment, plasma temperatures of up to 40,000°C are generated by a discharge current of 40 KA in a gas expanding through a supersonic nozzle (pressure drop 30 → 0 atm., terminal gas velocity ~ 1000 m/s). The significance of such experiments for improving the design and performance of various high tension switches and circuit breakers is explained. (NL)

Kinetics (Experimental)

9314 STARK BROADENING OF THE OVERLAPPING 4471.48 Å HeI LINE IN A PLASMA. Deutsch, C. (Laboratoire de Physique des Plasmas, Faculté des Sciences, 91405—Orsay, France); Sassi, M.; Coulaud, G. Ann. Phys. (N.Y.) 83: No. 1, 1-27 (Mar 1974).

The purpose of this paper is to provide a comprehensive study of the generalized impact formalism as applied to overlapping neutral lines, especially to the 4471.48 Å HeI line emitted in a plasma. First, we will discuss the specific algebraic modifications needed to adapt the impact theory to partially degenerate lines. Secondly, we will review briefly the time-averaged dipole width and shift functions. The corresponding impact parameter averages and other properties are given and discussed at length. Thirdly, we will show that the various proposals made for the long range cutoff of the electron impact parameter do not lead to significant discrepancies in the final line shape. The short range cutoff is shown to be dependent on the static splitting and it is the smallest for the nondiagonal elements of the collision matrix. Moreover, the nonmarkovian corrections to the frequency-independent impact theory appear to be of only marginal importance for the 4471.48 Å line in the line core, in contradistinction to the wings where more significant discrepancies are exhibited. These results strongly suggest that the nondiagonal part of the collision operator is dependent on the close perturbers collisions (weak collisions with the smaller impact parameter), so that the extension of the impact formalism to off diagonal matrix elements appears as an acceptable approximation, as long as the impact theory retains its validity. The impact formulation is seen to be self-consistent with respect to slow electron collisions which are automatically excluded when the static splitting is introduced in the collision operator. Finally, our profile calculations are compared with the previous ones and additional results with $2\times10^{16} \leq N_e \leq 6\times10^{16}$ e-cm^{-3} and $T_e = 2\times10^4$ K are presented. The dip between the two peaks is seen to be sensitively dependent on the perturber temperature. This effect combined with ion dynamic shielding and a self-consistent choice of the short impact parameter cutoff could allow for an important enhancement of the line intensity between the two peaks, and also a significant reduction of the theory-experiment discrepancy. (auth)

9315 PLASMA FOCUS EXPERIMENT (PF-150). Gryzinski, M.; Jerzykiewicz, A.; Nowikowski, J. (Inst. of Nuclear Research, Swierk, Poland). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 2, 135-140(Mar 1974).

An experimental device designed for investigations of high-current, noncylindrical z-pinch (plasma focus experiment) as well as the basic measurements is described. The investigations were carried out with cylindrical electrodes 20 cm long, 5-cm inner and 10-cm outer diameters at currents somewhat above 1 MA. The formation of the plasma focus of density 10^{18} cm^{-3} and a temperature of the order of 20 million degrees was established from the current–voltage characteristics, high speed photography, x-rays, and neutron measurements. An activation method was applied for absolute measurements of the neutron flux estimated as 5×10^9 neutrons per discharge in optimum gas conditions (14 torr of deuterium). (auth)

Kinetics (Theoretical)

Refer also to abstract 9340.

9316 (AD-771577) INITIAL VALUE PROBLEM IN A CLASS OF NONUNIFORM PLASMAS. Rahn, R. J. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Plasma Physics). Feb 1973. 86p. (LPP-5; AFOSR-TR-73-2089). NTIS $6.50.

The response of a plasma with a spatially nonuniform equilibrium state has usually been discussed in the framework of WKBJ approximations to the governing integral equations, or of multiple-slab models, or by computer studies. Using approximate integral equations derived from the fully nonuniform orbit-integral equation for self-consistent electrostatic fields, closed-form expressions for the plasma response under arbitrary initial conditions are derived by perturbation-iteration techniques. The method is applied to the time-asymptotic evaluation of the response in a non-

uniform plasma supporting a negative-energy mode and to the effect of nonuniform perturbations on a Landau-damped electron plasma wave. (auth)

9317 (COO-3086-27) RESEARCH IN COMPUTATIONAL PLASMA PHYSICS. Progress Report, June 1, 1973–May 31, 1974. Chu, C. K. (Columbia Univ., New York (USA)). 1974. Contract AT(11-1)-3086. 13p. Dep. NTIS $4.00.

Research in computational plasma physics is proceeding at Columbia. Problems completed include all two-dimensional simulations of the shock tube, the vacuum field calculation for the divertor section of the tube, and a numerical study of the proper boundary conditions for fluid codes. Two-dimensional simulation of toroidal pinches has been started with highly encouraging preliminary results. (auth)

9318 (IPF-72-4) SNOWPLOW CALCULATIONS FOR COAXIAL ACCELERATORS AND PLASMA FOCUS DEVICES. Erz, U. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). 1972. 118p. (In German). INIS.

The procedure for the acceleration and compression of a cylindrically symmetrical plasma was examined. In particular, the energy of the plasma focus following the compression phase was observed. The equations of motion, voltage and power were formed and numerically integrated. The results are discussed and compared with experimental data. (GE)

9319 (IPP-6-123) CONTRIBUTION TO THE EFFICIENT SOLUTION OF EXTENSIVE SYMBOLIC COMPUTATIONS. Kerner, W.; Steuerwald, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The solving of extensive algebraic problems with computers is difficult owing to the large amount of storage and computing time needed. A method is described that obviates these difficulties in many cases by using appropriate operators instead of extensive polynomials. This calculation is prompted by the question whether a class of algebraic equilibria in plasma physics governed by MHD theory is stable. Great accuracy is called for in treating this problem. The calculation of a three-dimensional integral containing Fourier, Taylor and trigonometric series is described. (auth)

9320 ON THE THEORY OF PLASMA TURBULENCE. Marcuvitz, N. (Polytechnic Institute of New York, Department of Electrical Engineering and Electrophysics, Graduate Center, Farmingdale, New York 11735). J. Math. Phys. (N.Y.) 15: No. 6, 870-879 (June 1974).

Microscopic to macroscopic transitions in classical, nonequilibrium, particle-field systems pose a class of stochastic perturbation problems that can be solved via the formal theory of scattering. Such solutions permit the nonlinear microscopic equations descriptive of a turbulent plasma field to be ensemble averaged into macroscopic particle- and wave-kinetic equations. The method is essentially operator theoretical. The original microscopic operator is first conventionally decomposed into deterministic and stochastic parts and then via scattering theory its inverse is evaluated in terms of explicit, formally exact, operator expressions that admit rapidly convergent, nonsecular, series representations. These results may be obtained by either operator algebra or diagram methods, the former being preferred. The derivation appears to be more physically and analytically transparent than in most existing procedures and has the virtue of exhibiting explicitly higher order terms, some of which are novel. The theory is illustrated for the case of a simple isotropic electron plasma by the derivation of kinetic equations for particles and for waves. (auth)

9321 THERMODYNAMIC PROPERTIES OF ALKALI METAL PLASMAS AND OF THEIR COMPONENTS. Reiter, F. W. (Commission of the European Communities, Ispra, Italy). Z. Naturforsch.; 28A: No. 10, 1676-1686(Oct 1973). (In German).

Thermodynamic functions of plasmas of alkali metals and of their components—diatomic molecules, atoms, simply charged ions and electrons—were calculated in the temperature range 298.15 to 10,000°K. It was assumed that the plasma was in thermodynamic and chemical equilibrium and in an ideal gas state. The internal partition functions of the components of the plasmas were calculated by summation term by term up to characteristic quantum numbers. These characteristic quantum numbers were determined by graphic and calculating methods. The thermodynamic functions of alkali metal plasmas and their components are discussed and compared with results calculated by approximative methods. (GE)

9322 SELF-CONSISTENT TREATMENT OF PARTICLE CORRELATIONS IN A CLASSICAL ONE-COMPONENT PLASMA. Jain, M.; Jain, S. C. (Rajasthan Univ., Jaipur, India). Indian J. Pure Appl. Phys.; 11: No. 10, 737-743(Oct 1973).

The effect of the particle correlations in a classical one-component plasma is investigated on the basis of the theory of Ichimaru for the dielectric function of a degenerate electron liquid. Results are presented for the various physical quantities such as the pair correlation function [g(r)], compressibility, correlation energy, etc. and compared with the previous available results. Substantial improvement upon the Debye–Huckel theory (classical RPA) is observed. The results obtained also show that they satisfy the compressibility sum rule to a degree better than the theory of Singwi et al. [Phys. Rev., B1 (1970), 1044] by considering up to three-particle distribution function and then only making a decoupling. Although the procedure in the present study gives a more sound physical representation, there is no significant improvement in the values of g(r) compared with those reported by earlier workers. (auth)

9323 SPECTRAL LINE BROADENING BY PLASMAS. Griem, H. R. Pure and Applied Physics, Volume 39. New York; Academic Press, Inc. (1974). 422p. $31.50.

A survey of the theory is followed by a review of Stark broadening experiments, with special emphasis on experiments capable of checking the accuracy or validity limits of the various approximations. Applications in laboratory plasma physics and astronomy are considered. Appendices contain tables of calculated Stark profiles or broadening parameters. (MOW)

9324 AUTOMATION OF THE DERIVATION OF DISPERSION RELATIONS. I. Cold Plasma Case. Rosen, B. (Stevens Inst. of Tech., Hoboken, NJ). J. Comput. Phys.; 15: No. 1, 98-115(May 1974).

The derivation of dispersion relations in plasma physics using symbolic manipulation by computer is described. The techniques developed to date should have application to a wider class of problems, viz., modal analysis of linearized partial differential equations in various branches of physics. The analytic approach can be used exclusively by minor changes in programming but we have found it convenient to use symbolic manipulation as an aid to automatic programming for dealing with physical problems. The programs include: VECTORS which converts vector equations into scalar ones, ORDERS which performs perturbation expansions and elementary Fourier analysis, DETERM which calculates secular determinants, and PARAM which performs matrix augmentation and truncation required in the analysis of parametric instabilities. Two examples are given. In the first the instabilities of relativistic E-layers are investigated and in the second the instabilities of an electron beam in a spatially varying magnetic field. PL/I-FORMAC was the programming medium used. (auth)

9325 NUMERICAL STUDY OF A CYLINDRICAL PLASMA EXPANSION IN A MAGNETIC FIELD. Cornille, P. (Commissariat a l'Energie Atomique, Villeneuve Saint-Georges, France). J. Comput. Phys.; 14: No. 4, 371-390(Apr 1974).

The cylindrical plasma expansion in an axially symmetric magnetic field is calculated with a magnetohydrodynamic code described herein. The hydrodynamic and electromagnetic variables are decoupled and computed separately with explicit methods. A two step Lax–Wendroff method is used for the hydrodynamic equations and a splitting technique applied to the vector potential for the field components. (auth)

9326 DYNAMIC STARK-EFFECT IN A TURBULENT HYDROGEN PLASMA. Rutgers, W. R.; de Kluiver, H. (Fundamenteel Onderzoek der Materie, Jutphaas, Netherlands). Z. Naturforsch.; 29a: No. 1, 42-44(Jan 1974).

The profiles of the first three Balmer lines of hydrogen were measured in a turbulent heating experiment. From the position of Stark satellites the field strength of low-frequency oscillations $\omega \sim \omega_\pi$ was calculated. The energy density in these electrostatic oscillations can amount to 1% of the thermal energy. The presence of high-frequency oscillations $\omega \sim \omega_\pi$ was concluded from satellites near ω_π from the unperturbed line position. (GE)

9327 ASPECTS AND APPLICATION OF PAIR CORRELATIONS IN THE PHYSICS OF MULTI-PARTICLE SYSTEMS WITH SPECIAL CONSIDERATION OF THE BEHAVIOR IN LIQUIDS AND PLASMA. I. General and Time-Independent Pair Correlations. Weil, J. W. (Innsbruck Univ., Austria); Kratky, K. W. (Innsbruck Univ., Austria). Acta Phys. Acad. Sci. Hung.; 34: No. 2-3, 139-159(1973). (In German).

The time-independent pair correlation function in the one- and two-dimensional form was considered. A one-dimensional form of the Born–Green equation was solved for two different potentials. Pair correlation functions were derived from structure factors and equations of state of some systems (Yukawa potential plasma, ideal Fermi gas of high temperature, and Van der Waals gas). Some consequences were discussed. (tr-auth)

9328 ASPECTS AND APPLICATIONS OF PAIR CORRELATIONS IN THE PHYSICS OF MULTI-PARTICLE SYSTEMS WITH SPECIAL CONSIDERATION OF THE BEHAVIOR IN LIQUIDS AND

PLASMA. II. Time-Dependent Pair Correlations. Weil, J. W. (Innsbruck Univ., Austria). Acta Phys. Acad. Sci. Hung.; 34: No. 2-3, 161-177(1973). (In German).

Time-dependent pair correlations in the sense of van Hove and Sunakawa were discussed. All applications considered originate from the area of plasma physics. On the basis of the relation between time-dependent pair correlation functions and the scattering of slow neutrons data are presented on the neutron scattering behavior of a plasma in a homogeneous magnetic field, an electron-ion plasma with ion sound vibration, and an ion system, which oscillates in an electromagnetic wave. (tr-auth)

9329 ELECTROMAGNETIC FLUCTUATIONS IN A PLASMA IN A WEAK MICROWAVE ELECTRIC FIELD. Markeev, B.M. (Institute for Mechanical Problems, Moscow). Sov. Phys.-Tech. Phys. 18: No. 7, 889-892 (Jan 1974).

Kinetic theory is used to consider the fluctuations in a nonisothermal plasma in a weak microwave electric field with collisional dissipation taken into account. The collisions are included through the Boltzmann integral. Expressions are obtained for the spectral distributions of particle density and potential. The scattering of electromagnetic waves in a weakly ionized plasma is considered. It is shown that when an electromagnetic wave propagates through a plasma the scattered spectrum contains ion-acoustic satellites as well as satellites at frequencies of $\pm(\omega_0+\omega_s)$ and $\pm(\omega_0-\omega_s)$ caused by fluctuations in the harmonics of the density distribution. As the microwave electric field strength approaches a threshold, the intensity of these satellites increases sharply. (auth)

Production

Refer also to abstract 11924.

9330 (CLM-R-130) MEDUSA: A ONE-DIMENSIONAL NUMERICAL MODEL FOR LASER FUSION CALCULATIONS. Christiansen, J. P.; Ashby, D. E. T. F.; Roberts, K. V. (UKAEA Research Group, Abingdon. Culham Lab.). Dec 1973. 15p. Dep. NTIS (US Sales Only) $4.00.

The physics and mathematics used in MEDUSA, a computer code designed for calculating the compression of a plasma by laser radiation together with the thermonuclear reactions that take place, are described. The physical processes and mathematical formulas are described. The numerical techniques employed in the model are discussed. (auth)

9331 (SLA-74-5001) ELECTRIC FIELD MEASUREMENTS IN LASER PLASMAS. Mendel, C. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 4p. (CONF-740617-2). Dep. NTIS $4.00.

From eighth international quantum electronics conference; San Francisco, California, USA (10 Jun 1974).

Electric fields in laser-produced plasmas were measured on a nanosecond time scale by observing the deflection versus time of a small-diameter, low-current proton beam. Fields of 0.5 kV/cm were observed 2 cm from CH_2 spheres irradiated by 1 J, 25 picosecond pulses from a Nd laser. Measurements closer to the target are also reported. (auth)

9332 FUSION POWER BY LASER IMPLOSION. Emmett, J. L.; Nuckolls, J.; Wood, L. Sci. Amer.; 230: No. 6, 24-37 (Jun 1974).

A comprehensive review of laser-produced fusion is given. The lasers being considered for the fusion program are briefly discussed. Some laser requirements along with fuel compression requirements and ignition conditions are described. A laser-fusion power plant is described along with some associated engineering problems. (MOW)

9333 INTERACTION OF SHOCK-WAVE PRODUCED PLASMAS WITH STRONG MAGNETIC FIELDS. Schmidt, H. Stuttgart; Univ. Stuttgart (1972). 219p. (In German). (IKE-72-2).

Thesis.

An argon plasma with T = 10,000°K, velocity v = 3,800 m/sec, ionization degree of 2% and electric conductivity of about 20 S/cm is produced in shock tubes with a quadratic cross section at Mach numbers from 10 to 14. The test times are between 0.020 and 0.180 msec. In an electrodeless range of about 12 cm, a quasistationary transversal magnetic field produced by a Helmholtz coil is applied. From measurements with Mach-Zehnder-interferometers, piezoelectric probes and emitted radiation the following conclusions are drawn: the plasma blob is retarded to subsonic velocities; the pressure in the interaction increases remarkably; the electron density increases by plasma heating due to compression and electric currents; the primary shock wave velocity is reduced by 15%; compressional waves are running to the contract surface and into the driver gas; after completion of the interaction a rarefaction wave is running against the flow and finally cancels the effects of the precursing compressional wave. The current distribution within the channel is calculated, taking into account the Hall effect and disregarding it. The Hall effect reduces the electric conductivity and pinches the zones of high current density. (GE)

9334 REVIEW OF GAS-BREAKDOWN PHENOMENA INDUCES BY HIGH-POWER LASERS. I. Shkarofsky, I. P. (RCA Ltd., Ste. Anne de Bellevue, Quebec). RCA Rev.; 35: No. 1, 48-78(Mar 1974).

This review concerns high-power laser interaction with gaseous media leading to breakdown. Laser-induced gas breakdown, the mechanisms involved, and experimental data are summarized. CO_2 lasers and atmospheric breakdown are of particular interest here. Phenomena related to discharges maintained, guided, or controlled by lasers are included. Finally the dynamics of a laser-induced breakdown spark and the expansion waves possible are outlined. (auth)

9335 SIMPLIFIED AVERAGED EQUATIONS OF CONCENTRIC LASER COMPRESSION OF PLASMA. Kaliski, S. (Instytut Podstawowych Problemow Techniki, Warsaw). Proc. Vib. Probl.; 14: No. 2, 105-115(1973).

Simplified averaged equations are derived which describe the concentric compression of a deuterium–tritium (D–T) plasma upon concentric heating of a D–T ball by a laser pulse. The core of the ball which undergoes compression is treated as a Fermi fluid model, while the external expanding layer of plasma is treated as a perfect gas. A nonlinear system of ordinary integro-differential equations is derived which can be solved by analog computers. (IAA)

9336 NUMERICAL ANALYSIS OF THE AVERAGED EQUATIONS OF LASER COMPRESSION OF A D–T BALL WITH COATING. Jach, K. (Instytut Podstawowych Problemow Techniki, Warsaw); Kaliski, S.; Swierczynski, R. Proc. Vib. Probl.; 14: No. 3, 221-236(1973).

The averaged equations derived by Kaliski (1973) to describe the laser heating of a plasma, making allowance for the thermal and shock fronts are solved and analyzed. The initial values of such parameters as the critical mass and the emission from the plasma are evaluated, and the accuracy of using the equations of state of a Fermi liquid to describe the compression of the plasma ball is assessed. (IAA)

9337 AVERAGED SIMILARITY EQUATIONS OF CONCENTRIC LASER COMPRESSION OF PLASMA. Kaliski, S. (Instytut Podstawowych Problemow Technik, Warsaw). Proc. Vib. Probl.; 14: No. 3, 193-207(1973).

The physical scheme discussed is a plasma ball heated concentrically by laser pulse, whose energy is absorbed by the rarefied plasma ejected from the plasma ball, and is imparted to the plasma ball by an electron conduction mechanism. It is assumed that the internal portion of the ball may be described by an integral similarity model. Using the integral similarity description, a set of averaged equations and boundary conditions is derived as a very general formulation of the problem of laser heating and concentric compression of a plasma. The equations make allowance for the phenomena associated with the thermal front and for the recovery of the energy of thermonuclear fusion. (IAA)

9338 VERSATILE LASER-CTR PULSE-TAILORING SYSTEM UTILIZING THE REAR EXCITATION OF PELLETS. Hughes, J. L.; Strachan, J. D. (Australian National Univ., Canberra). Nucl. Fusion; 14: No. 2, 292-296(Apr 1974).

A simple and inexpensive method for generating the laser pulse shape described by Nuckolls et al (Nature (London) 239 (1972)139) is described. The Nuckolls pulse has a total duration of approximately 25 ns, has less than 1% of its total energy in the first 10 ns and 50% of its total energy in the last 100 ps. The optical system for producing this pulse is described. (MOW)

Stability

Refer also to abstracts 9282, 9295, 9296, and 9399.

9339 (AD-771486) LITERATURE SURVEY ON PLASMA INSTABILITIES COVERING 1972 PUBLICATIONS. Part 1. Herrnegger, F.; Kuhn, S. (Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik). 30 Jun 1973. Contract F44620-72-C-0016. 207p. (AFOSR-TR-73-2087). INIS $5.50.

The first part of a literature survey on plasma instabilities covering the year 1972 is presented. This volume contains 150 abstracts and survey reports on single instabilities. (GRA)

9340 (COO-3077-49) THREE DIMENSIONAL COMPUTATION OF MAGNETOHYDRODYNAMIC EQUILIBRIUM OF TOROIDAL PLASMA WITHOUT AXIAL SYMMETRY. Betancourt, O. L. (New York Univ., N. Y. (USA). Courant Inst. of Mathematical Sciences). Jun 1974. Contract AT(11-1)-3077. 117p. (MF-67). Dep. NTIS $9.00.

A numerical scheme is developed to compute configurations of fully three dimensional magnetohydrodynamic equilibrium, which also allows one to study their stability properties. The results show that a torous with small aspect ratio is more stable than one with a large aspect ratio. For the same aspect ratio, an axially symmetric torus with circular cross section and an axially symmetric torus with elliptical cross section have similar stability properties. Several three dimensional configurations were also found which are more stable than neighboring axially symmetric cases. However, the improvement in the stability properties by introducing a three dimensional perturbation of the outer boundary is not nearly as big as the improvement obtained by lowering the aspect ratio. This might not be the case for three dimensional configurations which are very different from the axially symmetric case, a possibility which one can explore by extending the method to a more general coordinate system as previously discussed. (auth)

9341 (IPF-73-1) INSTABILITY BEHAVIOR OF THE POSITIVE COLUMN OF A DIFFUSION-DETERMINED LOW-PRESSURE GAS DISCHARGE IN A LONGITUDINAL HOMOGENEOUS MAGNETIC FIELD. Moser, F. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). 1973. 104p. (In German). INIS.

The stability behavior of the positive column of a diffusion-determined low-pressure gas discharge in a longitudinal, homogeneous magnetic field was investigated. Based on the system of the fundamental equations of the three-liquid theory in the hydrodynamic form, equations were derived which were used to study wave phenomena of the drift-dissipative type in the plasma of the positive column. As the basic steady-state solution for the radial density distribution of the electrons or ions, and for the electric potential, Schottky's solution in its modified form, with superimposed magnetic field, is obtained. (GE)

9342 (NP-20005) INVESTIGATION OF THE DRIFT WAVE SPECTRA IN THE PLASMA, GENERATED BY HF POWER AT THE LOWER HYBRID RESONANCE. Baranov, Yu. F.; Bulyginskii, D. G.; Vil'dzhyunas, M. I.; Galaktionov, B. V.; Shustova, N. V. (AN SSSR, Leningrad. Fiziko-Tekhnicheskij Inst.). 1973. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The evolution of the drift wave spectra was investigated in argon plasma maintained by electromagnetic fields at the frequency near the lower hybrid resonance. It was shown that the spectrum characteristics changed gradually from almost monochromatic in the beginning of the discharge pulse, becoming quite noisy at some critical conditions. These critical plasma parameters are connected with the density drops observed earlier. (auth)

9343 (ORNL-TM-4584) STABILITY OF MAGNETICALLY-CONFINED, HIGH-BETA PLASMA. Guest, G. E.; Hedrick, C. L.; Nelson, D. B. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 17p. Dep. NTIS $4.00.

Plasma waves propagating perpendicular to the magnetic field in a high-beta, magnetically-confined plasma can be unstable in configurations for which the guiding-center drifts are in the "favorable" direction. The basic instability mechanism is illustrated and the conditions for growth are given using the Maxwell and Vlasov equations in a slab model of the plasma. (auth)

9344 (ORO-2598-7) INSTABILITIES DUE TO ANISOTROPIC VELOCITY DISTRIBUTIONS. Progress Report, 1 June 1973-1 June 1974. Harris, E. G. (Tennessee Univ., Knoxville (USA). Dept. of Physics). 1974. Contract AT(40-1)-2598. 13p. Dep. NTIS $4.00.

Summaries of research work are given for problems concerning the equilibrium, stability, and heating of tokamaks. (MOW)

9345 THEORY OF ELECTRON ACCELERATION DURING PARAMETRIC INSTABILITIES. Weinstock, J.; Bezzerides, B. (Aeronomy Laboratory, National Oceanic and Atmospheric Administration, Boulder, Colorado 80302). Phys. Rev. Lett. 32: No. 14, 754-758 (8 Apr 1974).

A calculation is made of the steady-state acceleration of electrons by parametrically excited Langmuir waves in a spatially homogeneous plasma. Collisions are accounted for by a simple relaxation model. An algebraic expression is given for the number density of hot electrons. (auth)

9346 FEEDBACK STABILIZATION OF DRIFT TEMPERATURE INSTABILITY. Lakhina, G. S.; Sen, A. (Physical Research Lab., Ahmedabad, India). Nucl. Fusion; 14: No. 2, 285-287(Apr 1974).

It was found that by applying feedback methods, it is possible to suppress all drift temperature modes, except the slow ion acoustic-mode, by means of negative feedback at 180° phase. The slow ion acoustic mode can be suppressed by a positive feedback at 90° phase. The most dangerous mode, which is a macroscopic instability arising purely owing to temperature gradients and which cannot be stabilized by dynamic methods, can be suppressed by a feedback method. (MOW)

9347 MICROINSTABILITIES IN INHOMOGENEOUS MIRROR-CONTAINED PLASMAS: NUMERICAL RESULTS. Beasley, C. O. Jr. (Oak Ridge National Lab., TN); Hicks, H. R.; Farr, W. M.; McCune, J. E. Nucl. Fusion; 14: No. 2, 191-218(Apr 1974).

Results are presented from studies of microinstabilities in a model mirror plasma. The model has a Gaussian density distribution of ions and electrons along a varying magnetic field, and a radial density gradient perpendicular to this field. Particles are contained self-consistently by a fictitious confining potential modelling mirror confinement. The ion velocity-space distribution is the finite-plasma equivalent of a Guest-Dory loss-cone distribution, and the electron distribution allows for finite-temperature effects, including Landau damping. Resonant and non-resonant loss-cone instabilities are discussed. It is found that resonant instabilities are stabilized when the plasma length is less than a critical length which is dependent upon electron temperature, but modes corresponding to flute modes in homogeneous plasmas (Dory-Guest-Harris and drift-cone) are found to remain unstable at all plasma lengths. (auth)

9348 PERFORMANCE CHARACTERISTICS OF FUTURE TOKAMAK REACTIONS. Stacey, W. M. Jr. (Argonne National Lab., IL). Nucl. Fusion; 14: No. 2, 219-228(Apr 1974).

Current transport theory is extrapolated to predict the performance characteristics of future tokamak power reactors operating in a quasi-steady-state mode. Criteria for the suppression of macroscopic instabilities are used to delimit a stable reactor regime. Microscopic instabilities are accounted for by enhancement of the transport coefficients. The effect of variations in reactor size and aspect ratio, toroidal current, injected ion source strength, and toroidal magnetic field strengths are evaluated. Results are presented in terms of engineering parameters such as fractional fuel burn-up and power output. (auth)

9349 VERTICAL STABILITY OF ELONGATED TOKAMAKS. Okabayashi, M.; Sheffield, G. (Princeton Univ., NJ). Contract AT(11-1)-3073. Nucl. Fusion; 14: No. 2, 263-265(Apr 1974).

The vertical stability of an elongated tokamak plasma with infinite conductivity is numerically investigated under simple assumptions, in toroidal co-ordinates. The rectangular configuration is stable for an elongation ratio of less than $3 \sim 4$, depending upon the current profile. It is shown that the stabilization at high elongation ratio is related to the rotational-transform constraint. (auth)

9350 EQUILIBRIUM OF AN ANISOTROPIC TOROIDAL PLASMA. Yashin, V.I. Sov. Phys.-Tech. Phys. 18: No. 7, 992-993 (Jan 1974).

Two forms of plasma equilbrium in the magnetohydrodynamic approximation in an anisotropic toroidal system are considered. Relations are given between the equilibrium components of the pressure. Criteria for the "fire-hose" instability are given. (auth)

9351 PARAMETRIC EXCITATION OF AN ELECTRON PLASMA. Loladze, T.D.; El'-Ashri, M.Y. (Institute of Physics, Academy of Sciences of the Georgian SSR, Tbilisi). Sov. Phys.-Tech. Phys. 18: No. 7, 897-898 (Jan 1974).

A study is made of the parametric excitation of high-frequency electromagnetic oscillations in a relativistic electron plasma in a strong external rf electric field of the form $E_0(t) = \Sigma_i E_i(0) \sin \omega_i t$. The growth rates of the oscillations are found as functions of the frequency and amplitude of the field components. The depth to which the field penetrates into the plasma is calculated. (auth)

9352 ELECTRON-ACOUSTIC AND ION CYCLOTRON PARAMETRIC INSTABILITIES OF A PLASMA IN AN ALTERNATING ELECTRIC FIELD. II. Kitsenko, A.B.; Panchenko, V.I.; Stepanov, K.N. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR). Sov. Phys.-Tech. Phys. 18: No. 7, 911-915 (Jan 1974).

The parametric instability of a homogeneous plasma in an alternating electric field perpendicular to a magnetic field is analyzed. It is assumed that the relative velocity of the electrons and ions is less than or of the same order of the ion thermal velocity and that the frequency of the alternating field is of the order of the ion cyclotron frequency. The

growth rates of the electron–acoustic and ion cyclotron modes are determined for cases in which resonance ions and electrons having a velocity of the order of the average thermal velocity play the dominant role in the stimulation of the oscillations. The maximum values of the growth rates of the investigated kinetic instabilities can be comparable with those of the hydrodynamic parametric instabilities in this frequency range. (auth)

9353 LINEAR THEORY OF TRANSVERSE CURRENT INSTABILITIES IN A PLASMA. Aref'ev, V.I. Sov. Phys.–Tech. Phys. 18: No. 7, 916-920 (Jan 1974).

Plasma instabilities are studied in a plasma in which the density of the current flowing at right angles to the magnetic field is appreciably greater than the density of the equilibrium Larmor current. A strong transverse current of this kind can flow, for example, at the front of a nonlinear magnetohydrodynamic wave. It is shown that the plasma exhibits new spectra of unstable modes because of the effect of resonances at harmonics of the electron cyclotron frequency (Bernstein modes). These instabilities have relatively high growth rates $\sim\omega_{He}$ and makes an appreciable contribution to the anomalous resistance. (auth)

9354 INSTABILITY OF AN AZIMUTHAL ION BEAM IN A DENSE PLASMA. Goncharov, A.A. (Institute of Physics, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. Phys.–Tech. Phys. 18: No. 7, 924-927 (Jan 1974).

High–frequency ($\omega>\omega_{Hi}$) instabilities excited by a radially inhomogeneous hollow ion beam in a dense ($\omega_{pi}>\omega_{Hi}$) homogeneous plasma are studied. A dispersion equation is obtained for longwave "surface–wave" modes which are localized at the beam and plasma boundaries. It is shown that gradient effects are unimportant for beam velocities $V_0>C_s$. Shortwave modes are considered and it is shown that the maximum growth rate can reach values $\sim a^{1/3}\omega_{pi}$; these are typical of the two-stream instability and of the order of γ_{max} for a beam of oscillators. (auth)

9355 PLASMA OSCILLATIONS IN CLOSED-DRIFT ACCELERATORS WITH AN EXTENDED ACCELERATION ZONE. Esipchuk, Y.B.; Morozov, A.I.; Tilinin, G.N.; Trofimov, A.V. Sov. Phys.–Tech. Phys. 18: No. 7, 928-932 (Jan 1974).

Oscillations in a closed–drift accelerator with an extended acceleration zone (CDAE) are studied. Two instabilities, an ionization instability and a transit–time instability, are found. For the ionization wave, electron drift in the crossed $\tilde{E}_\varphi$ (variable component) and H, fields leads to enhanced transverse diffusion. (auth)

9356 ELECTRON–ACOUSTIC AND ION CYCLOTRON PARAMETRIC INSTABILITIES IN AN ALTERNATING ELECTRIC FIELD. I. Kitsenko, A.B.; Panchenko, V.I.; Stepanov, K.N. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR). Sov. Phys.–Tech. Phys. 18: No. 7, 905-910 (Jan 1974).

The parametric instability of a homogeneous plasma in an alternating electric field perpendicular to a magnetic field is analyzed. It is assumed that the relative velocity of the electrons and ions u is smaller than or of the same order as the ion thermal velocity and that the frequency of the alternating electric field is of the order of the ion cyclotron frequency. The growth rates of the electron–acoustic and ion cyclotron oscillations are determined for cases in which it is permissible to neglect the interaction of the oscillations with resonance particles and the oscillations are stimulated coherently. The threshold value of the velocity u, above which the oscillations are unstable, is determined. (auth)

9357 CYCLOTRON PLASMA INSTABILITY IN AN INHOMOGENEOUS MAGNETIC FIELD. Kukushkin, A.S. Sov. Phys.–Tech. Phys. 18: No. 7, 899-901 (Jan 1974).

We analyze cyclotron oscillations of a collisionless low-density plasma cylinder with an anisotropic nonmonotonic ion velocity distribution and hot Maxwellian electrons in a magnetic field along the cylinder aixs that depends weakly on the radius. Using the Vlasov equation for the ions and electrons and Poisson's equation for the electric field, Galerkin's method is used to obtain an approximate dispersion relation, which is investigated numerically. Using the parameters $\omega^2_{pe}/\omega^2_{ci}$ and $T_{i\perp}/T_{i\parallel}$ we plot the instability regions of the various modes at the ion cyclotron frequency and its harmonics. It is shown that inhomogeneity of the field can lead to selection of one of the modes.

9358 NONLINEAR SCHRÖDINGER–EQUATION MODEL OF THE OSCILLATING TWO–STREAM INSTABILITY. Morales, G.J.; Lee, Y.C.; White, R.B. (Physics Department, University of California, Los Angeles, California 90024). Phys. Rev. Lett. 32: No. 9, 457-460 (4 Mar 1974).

This one–dimensional model exhibits a strong spatial collapse of the electric field when the self–consistent pump amplitude is held constant. The linear instability saturates if one allows for the self–consistent modification of the pump due to nonlinearities. The saturated state is characterized by relaxation oscillations and spatially localized electric fields of finite amplitude. (auth)

Thermonuclear Engineering and Equipment

Refer also to abstract 9290.

9359 (BNL–18792) DAMAGE ENERGY CROSS SECTION AND PRIMARY RECOIL SPECTRA FOR CTR-RELATED NEUTRON SOURCES. Parkin, D. M.; Goland, A. N.; Berry, H. C. (Brookhaven National Lab., Upton, N. Y. (USA)). 1973. 13p. (CONF-740402-37). Dep. NTIS $4.00.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

A brief description is given of a model for calculating damage energy cross sections, and primary recoil spectra for an arbitrary incident neutron spectrum using data from the ENDF/B files. Damage energy cross sections for Nb, V, Ti, Al, and C are compared, and spectrum–averaged cross sections for Nb in twelve different spectra are given. The relative merits of various neutron sources for simulation of CTR radiation effects are discussed, and it is concluded that deuteron breakup sources closely simulate first–wall effects. (auth)

9360 (BNL–18815) APPLICATIONS OF FUSION POWER TECHNOLOGY TO THE CHEMICAL INDUSTRY. Beller, M.; Powell, J. R.; Steinberg, M. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 40p. (CONF-740609-2). Dep. NTIS $5.00.

From 77th national meeting on the American Institute of Chemical Engineers; Pittsburgh, Pennsylvania, USA (2 Jun 1974).

Energy forms available from Controlled Thermonuclear Reactors (CTR) are reviewed, and methods of application to chemical processes are discussed. Specific chemical processes which can utilize CTR energy are described, and the potential for this utilization is assessed. (auth)

9361 (BNWL–1823) PACIFIC NORTHWEST LABORATORY ANNUAL REPORT FOR 1973 ON CONTROLLED THERMONUCLEAR REACTOR TECHNOLOGY. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1974. Contract AT(45–1)–1830. 67p. Dep. NTIS $4.00.

Summaries of research during this period are given for the following: (1) systems design and analysis, (2) materials research and radiation environment simulation, (3) blanket design, and (4) plasma physics. (MOW)

9362 (CONF-740402-22) SOME PRELIMINARY CONSIDERATIONS OF A MOLTEN-SALT EXTRACTION PROCESS TO REMOVE TRITIUM FROM LIQUID LITHIUM FUSION REACTOR BLANKETS. Maroni, V. A.; Wolson, R. D.; Staahl, G. E. (Argonne National Lab., Ill. (USA)). Apr 1974. 13p. Dep. NTIS $4.00.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

A method for removing tritium from liquid lithium fusion reactor blankets by extraction with a molten salt is described. Results of distribution coefficient measurements made with lithium–lithium halide mixtures have demonstrated that tritium is preferentially distributed in the salt phase by a factor greater than 1.0 on a volumetric basis. Other considerations related to (1) mutual solubilities between the salt and metal, (2) phase separation, (3) blanket neutronics, (4) corrosion, (5) fabrication, and (6) recovery of tritium from the salt phase indicate that the extraction process should be feasible. Calculations based on the blanket processing requirements for the LASL/ANL Reference Theta–Pinch Reactor (RTPR) show that the equipment and power needed to carry out a molten–salt extraction operation on the lithium blanket of the RTPR are reasonable. (auth)

9363 (IFA-FR-118-1974) QUESTIONS ABOUT THE FEASIBILITY OF A THERMONUCLEAR REACTOR THE PLASMA OF WHICH IS CONTROLLED BY NUCLEAR FISSION. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

The plasma within a thermonuclear reactor is considered using a magnetohydrodynamic approach. The plasma is studied from the standpoint of binary and collective collisions occurring within the Debye radius. Thermonuclear power densities for two boundary conditions are described. Overheating of the plasma by resonance absorption of electromagnetic radiation is discussed. (MOW)

9364 (IPF–73–2) NUMERICAL PARAMETER STUDIES CONCERNING THE PLASMA FOCUS. Trunk, M. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). 1973. 69p. (In German). ZAED.

In accordance with a plasma focus code which by means of the Lax-Wendroff integration model in Euler's coordinates

solves the whole set of magnetohydrodynamic basic equations for collisional and collisionless plasmas in two-dimensional geometry, a program was developed which gives and optimizes the starting parameters for the Stuttgart focus apparatus 'Minifocus' and 'Nessi'. The calculated total parameters such as the total current, condenser voltage, inductance, running speeds and time of discharge agree quantitatively with the experiment, whereas the local plasma variables, in particular the temperatures calculated, only exhibit qualitative approximations. Following an introductory survey on the development of the focus machine from the z-pinch machines as well as on the running and the numerical calculation of the focus discharge, the MHD basic equations for the focus geometry are developed and the Lax-Wendroff integration process is explained. In addition, the numerical results for the axial running phase, collapse and focus phase are discussed and illustrated graphically. Furthermore, the effect of a focus apparatus on the energy balance and heating mechanism is dealt with. Finally, the variations of parameters as regards optimization are discussed and the results of the MHD calculation are compared with the experimental results. (GE)

9365 (IPP-1-137) SCALING OF A WALL-STABILIZED HIGH-BETA STELLARATOR. Herrnegger, F.; Kaufmann, M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jan 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

On the basis of the surface current model, the scaling of an m = 1 wall-stabilized high-β stellarator is discussed in terms of the compression ratio κ, aspect ratio A, helical distortions δ_0, δ_1, δ_2, and β. The m = 1, k = 0 mode can be wall-stabilized for $\kappa \simeq 2$, $\delta_1 \simeq 1$, $A \simeq 200$, $\beta \simeq 0.83$, $\delta_0 \simeq 0.21$, $\delta_2 \simeq 0.07$. The number of periods around the torus is then $n_0 \simeq 0.6\ A/\kappa^2$. (auth)

9366 (IPP-1-143) NEUTRON FLUX DISTRIBUTION ON THE WALL OF TOROIDAL CONTROLLED THERMONUCLEAR REACTOR DEVICES WITH ELONGATED CROSS SECTION. Becker, G.; Wunderlich, R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Feb 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

The neutron flux distribution on the wall of a toroidal CTR device with strongly elongated cross section was calculated. On the inner and outer cylindrical walls (belt-pinch device) the flux distribution has a plateau region with a half-width equal to about the height of the plasma. The maximum flux is found on the outer cylinder and in the symmetry plane ($z_0 = 0$). The neutron flux asymmetry and reduction η of the mean wall loading are determined. For standard data an η of 57% is computed. This is mainly due to the flux profiles on the cylindrical walls and does not depend sensitively on the toroidal curvature. For standard parameters the inner cylinder absorbs 22.6%, the outer cylinder 68.6% and the end plates together 8.8% of the total neutron emission. The corresponding values for a straight device with the same coil and plasma cross section are 44%, 44% and 12%. A reduction of toroidal curvature diminishes flux asymmetry between the inner and outer cylinders. The maximum flux and minimum η-value are obtained at a large torus radius equal to two times the coil width. (auth)

9367 (IPP-1-144) AXIAL CONTRACTION IN TOROIDAL PINCHES WITH NON-CIRCULAR PLASMA CROSS-SECTIONS. Becker, G. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

The axial contraction of toroidal pinches with racetrack-shaped and elliptic cross sections was studied by δW-analysis near the equilibrium shape. A surface current profile and a fixed plasma cross-section area are assumed. It is shown for the corresponding special perturbation that δW is given by the variation of the surface energy $\delta W = \delta W_s = (1/8)\ B_{p\,b}^2 \xi_b^2$, and that δW is nearly independent of the shape of the plasma (racetrack or ellipse). The axial oscillation frequency is found to be $\omega_{ax} = (1/2\sqrt{C})/(B_p/\sqrt{\rho_l})$ with a constant $C < 1$. The model correctly predicts the B_p and ρ_l-dependences of the experimental belt-pinch results and yields theoretical ω_{ax}-values a factor of 2 above the experimental ones. (auth)

9368 (IPP-IV-66) POSSIBILITY OF THE SIMULATION OF A SLOW-WAVE SYSTEM BY A PHASED ARRAY OF WAVEGUIDES. Tutter, M.; Puri, S. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Feb 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

From general considerations it is shown that neither a flush mounted waveguide nor a phased array of waveguides is capable of simulating a transverse-magnetic (TM) slow-wave structure. Their superficial resemblance to slow-wave systems is traced to the paradox of Mach's "Wave Machine". (auth)

9369 (IPP-4-117) MAGNETIC IRON-CORE MODEL AND STRAY FIELD MEASUREMENTS FOR PULSATOR I AND THEIR RELEVANCE TO JET. Gernhardt, J.; Herppich, G.; Werner, F. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Feb 1974. 12p. (IPP-III-11). Dep. NTIS (US Sales Only) $4.00.

Results of the measurements at the Pulsator I iron core magnetic model are compared with the stray field measurements at the original core. Special regard is given to the plasma simulation. Outlines for a JET model are presented. (auth)

9370 (IRS-S-6) PROFESSOR ALFVEN ON NUCLEAR FUSION: REMARKS IN ANSWER TO AN OPEN LETTER. Merton, A. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e. V., Koeln (F. R. Germany)). Apr 1972. 7p. (In German). INIS.

The proposal of Alfven to use only conventional (fossil) fuels until fusion reactors are in full operation has been faced with considerable opposition. The intermediate use of fission and breeder reactors is discussed in the light of economics, plutonium production, radioactivity, and nuclear safeguards. (GE)

9371 (LA-5530-SR) PRESENT STATUS AND FUTURE PROGRAM OF THE ZT-1 EXPERIMENT. Phillips, J. A.; Di Marco, J. N.; Jahoda, F. C. (comps.). (Los Alamos Scientific Lab., N. Mex. (USA)). Mar 1974. Contract W-7405-eng-36. 35p. Dep. NTIS $4.00.

The background, current status, and future program of the ZT-1 experiment are presented. The ultimate objective of the experiment is to formulate the requirements for a fusion reactor using the diffuse toroidal pinch. This type of pinch has toroidal equilibrium and is theoretically fully MHD stable with high total betas, ≤30%. Measurements of plasma properties include plasma temperatures ($T_i + T_e$) > 1 keV, electron temperature measurements indicate a non-gaussian velocity distribution and electron temperatures <100 eV, and ion temperatures ≥850 eV under some operating conditions. As the theoretical conditions for stability are approached, the pinch is found experimentally to be closer to having complete MHD stability. A critique of a review panel is also included. (auth)

9372 (LA-UR-74-627) UPDATE OF FIRST-WALL INSULATOR REQUIREMENTS FOR THE REFERENCE THETA-PINCH REACTOR (RTPR). (A Summary Review of Material Reported Since April 1973). Krakowski, R. A.; Clinard, F. W. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 33p. (CONF-740446-2). Dep. NTIS $4.75.

From CTR insulator committee meeting; San Diego, California, USA (19 Apr 1974).

The RTPR design and materials evaluations are reviewed. The anticipated requirements of an Al_2O_3/Nb first wall are discussed along with current data. (MOW)

9373 (LA-UR-74-628) REVIEW OF SFX/FTR FIRST-WALL RESEARCH AND DEVELOPMENT PROGRAM AT LASL. Krakowski, R. A.; Thomassen, K. I. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 13p. (CONF-740446-1). Dep. NTIS $4.00.

From CTR insulator committee meeting; San Diego, California, USA (19 Apr 1974).

The specific design and fabrication problems anticipated for the first-wall vacuum requirements, tritium handling, implosion heating/adiabatic compression coils, and general experimental layout are discussed. A summarized description of the Scientific Feasibility Experiment/Fusion Test Reactor (SFX/FTR) is given. Some materials requirements for the SFX/FTR are described. (MOW)

9374 (MATSCIENCE-78, pp 261-270) PROSPECTS OF FUSION POWER. Ananthakrishnan, N. (Seethalakshmi Ramaswami Coll., Tiruchy, India). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The discussion of the prospects of fusion power covers energy options of the future, controlled fusion with its mechanisms and brief history of research, typical fusion reactions, fuel for a fusion power energy source, the fundamental requirements for fusion energy release in a reactor, and the development time for fusion power. (JFP)

9375 (NP-20001) PROPERTIES OF THE MAGNETIC FIELDS OF STELLARATORS WITH ELLIPTICAL COILS. Popryadukhin, A. P. (AN SSSR, Moscow. Fizicheskij Inst.). 1973. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The configurations and properties of the magnetic field of stellarators with elliptical coils were calculated. The calculations were made on simulated systems, but the results can be

applicable to real systems. The results showed that a system of elliptical coils can have a large magnetic aperture such that in a real system with finite cross section of the windings, the dimensions of the plasma will be determined simply by the dimensions of the gaps in the coils. Increase of the mean radius of the plasma filament leads to a significant increase of the extent at decreased value of the parameter m characterizing the size of the counter-field. A system of elliptical coils is substantially different from the stellerator with helical conductors of the magnetic field geometry. The appearance of negative widths is possible at the edge of the aperture. (JSR)

9376 (NP-20011) FOIL BREAKER FOR MEGAAMPERE CURRENT IN THE MICROSECOND RANGE. Dubovoi, L. V.; Roife, I. M.; Seredenko, E. V.; Stekol'nikov, B. A. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1973. 8p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The design and operating characteristics of a quick-acting current circuit breaker, using metallic foils in quartz sand are described. The possibility of using this design to break MA currents for the period of 10^{-6} to 10^{-5} sec in the systems with the storage time of 10^{-5} to 10^{-4} sec is shown. (auth)

9377 (UCID-16229) SOME DIRECT CONVERSION POSSIBILITIES FOR ADVANCED CTR SYSTEMS. Wood, L.; Weaver, T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Mar 1973. Contract W-7405-eng-48. 22p. Dep. NTIS $4.25.

Some of the means for directly converting fusion energy into electricity in various types of CTR systems are surveyed. It is concluded that relatively simple and efficient means exist for converting essentially all forms of energy outputted from a thermonuclear reaction zone. It is noted that CTR power plants burning exotic fuels—nuetron- and radionuclide-free nuclei combinations—maximally exploit the profound asymmetries between fission and fusion power sources, asymmetries that potentially strongly favor fusion-based means of electricity generation. (auth)

9378 (UCID-16230) EXOTIC CTR FUELS FOR DIRECT CONVERSION-UTILIZING FUSION REACTORS. Weaver, T.; Wood, L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Mar 1973. Contract W-7405-eng-48. 22p. Dep. NTIS $4.25.

The prospects for the use of exotic CTR fuel systems, to enhance the efficiency and economy of electrical energy production and to reduce neutron-induced structural damage and radioactivation relative to the standard fuels (DT, DD, and DHe^3), are surveyed. The pB^{11} fuel system is found to be especially attractive in these respects, and it has an optimal $n\tau$ and burn temperature range (T_i > 100 keV) comparable to those of DHe^3. The importance of non-thermal effects in augmenting the performance of pB^{11} and exotic fuel systems (especially fusion chains) in general is emphasized, and calculational methods outlined. The large gaps that exist in the knowledge of the nuclear cross-sections needed to do these calculations accurately are pointed out. (auth)

9379 (UCID-16309) FUSION MICROEXPLOSIONS, EXOTIC FUSION FUELS, DIRECT CONVERSION: ADVANCED TECHNOLOGY OPTIONS FOR CTR. Weaver, T.; Nuckolls, J.; Wood, L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Apr 1973. Contract W-7405-eng-48. 30p. Dep. NTIS $4.50.

In the past few years, several new technological options related to controlled fusion have been developed that promise to dramatically improve the long term prospects for the production of inexpensive electrical energy with minimal environmental impact. Three of these options are briefly described, i.e., laser-initiated fusion microexplosions, exotic fuel usage, and new forms of conversion of fusion energy directly to electricity. While these technologies do not depend on each other for their useful realization, they rather naturally combine to form an extremely attractive fusion reactor system. (auth)

9380 (UCID-16474) PARAMETER STUDY OF B_z LINER IMPLOSIONS FOR POSSIBLE CTR APPLICATIONS. Condit, W. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jan 1974. Contract W-7405-eng-48. 28p. Dep. NTIS $4.50.

Results of a preliminary parameter study of near-breakeven B_z liner implosions are presented. The calculations were done using magnetic fields of up to 400 kg and liner radii in the range 45 to 90 cm, with plasma preheats in the 100 to 200 eV range. Breakeven is found to occur near 100 MJ/meter input to the system for copper liners with the 400 kilogauss drive field. For lighter metals, the energy requirement is roughly proportional to $1/\rho$. For lower drive pressure the yield is only slightly decreased. The results, though reasonably complete in their coverage of the different parameters, are only preliminary. Suggestions for further studies are made. (auth)

9381 (UCRL-74054-2) PROGRESS REPORT NO. 2 ON THE DESIGN CONSIDERATIONS FOR A LOW POWER EXPERIMENTAL MIRROR FUSION REACTOR. Werner, R. W.; Carlson, G. A.; Hovingh, J.; Lee, J. D.; Peterson, M. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Apr 1974. 112p. (CONF-730971-1). Dep. NTIS $8.75.

From CTR engineering systems study review meeting; Germantown, Maryland, USA (19 Sep 1973).

The conceptual design of a 200-MW(e) mirror fusion reactor is discussed. The reactor uses DT plasma fuel magnetically contained by the Yin–Yang magnet geometry. The reactor is fueled by 500-keV neutral particles injected into an ellipsoidal plasma volume of 130 m^3. The plasma ion density is 1.2×10^{14} cm^{-3}. The vacuum magnetic field requirements are 50 kG at the center of the reactor and 150 kG at the mirrors. Thermal energy is obtained by fusion neutron moderation in a 1 m thick Li–C–Fe blanket surrounding the plasma. Direct conversion of the charged particle energy uses the Post-type converter with electrostatic focusing. The design emphasizes the interaction between plasma physics and engineering and considers the plasma, containment magnet, injection, neutronics, blanket energy conversion, tritium recovery, and charged particle energy conversion both as separate subsystems and as elements of the total reactor system. (auth)

9382 (UCRL-75293) SUMMARY OF A CONCEPTUAL DESIGN OF A MIRROR REACTOR FOR A FUSION ENGINEERING RESEARCH FACILITY (FERF). Taylor, C. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Apr 1974. 8p. (CONF-740402-38). Dep. NTIS $4.00.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

A self-consistent design of a mirror FERF was described using Nb–Ti superconductors. It is possible to utilize the high field Nb_3Sn material to increase the neutron flux by 3. The design reveals many of the difficult problems of a fusion power reactor, such as tritium handling and "hot" maintenance. The basic engineering technology is available; however, extensive development must be undertaken to make a reliable design. Such development would include: Nb_3Sn superconductors, continuous duty neutral injectors, 1st wall heat transfer and fabrication, development of a variety of remotely operated manipulators and tools. In addition, the scaling of mirror plasma confinement with temperature and geometry must be experimentally verified and a start-up method must be developed. Such development must be done for any devices which are to produce significant fusion power. (auth)

9383 (UCRL-75627) CALCULATIONS OF A FAST FISSION BLANKET FOR DT FUSION REACTORS WITH TWO EVALUATED DATA LIBRARIES. Haight, R. C.; Lee, J. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Apr 1974. 17p. (CONF-740452-1). Dep. NTIS $4.00.

From American Nuclear Society conference; LaJolla, California, USA (16 Apr 1974).

A conceptual fusion–fission hybrid reactor blanket of Werner and Lee was investigated with two evaluated data libraries, the ENDF/B-III and the Lawrence Livermore Laboratory Evaluated Nuclear Data Library (ENDL). Significant differences were found for tritium breeding, ^{239}Pu breeding, and energy production through fission of uranium in the blanket. These differences are due primarily to differences in the 14-MeV neutron-induced emission spectra as evaluated in the two libraries. (auth)

9384 THEORY OF POTENTIAL-WELL FORMATION IN AN ELECTROSTATIC CONFINEMENT DEVICE. Black, W.M. (Physics Department, George Mason University, Fairfax, Virginia 22030); Klevans, E.H. J. Appl. Phys. 45: No. 6, 2502-2511 (June 1974).

A theoretical model is developed to describe the behavior of an ion-injection electrostatic confinement device. It is assumed that there is a shallow potential well in the center. Distribution functions, which are consistent with atomic processes occurring and with mechanisms leading to particle angular momentum, are obtained for ions and electrons. Using these distribution functions, Poisson's equation is solved to obtain potential and density profiles. By varying the experimental parameters, the conditions needed to go from a shallow potential well to a deep potential well are studied. The most important problems are found to be nonspherical focusing through grid construction asymmetry, and neutralization by electrons. Deeper wells are produced by increasing ion perveance, improving spherical symmetry, and reducing pressure. (auth)

9385 DEVELOPMENT AND SYNTHESIS OF THE URAGAN STELLARATOR AND INVESTIGATION OF MAGNETIC SURFACES OF HIGH SHEAR. Aleksin, V. F.; Biryukov, O. V.; Vishnevetskii,

V. N. Fiz. Plazmy Probl. Upr. Termoyad. Sin.; No. 3, 73-112 (1972). (In Russian).

After an initial section devoted to a review of the literature on the magnetic surfaces of toroidal stellarators and the principles of stellarators in general, the authors analyze the "Uragan" specifically. In particular, this paper is concerned with the problems involved in choosing the parameters of the magnetic system for the racetrack stellarator to obtain magnetic surfaces with high shear. This last term is defined as the extent of crossing of the magnetic lines of force. The synthesis and adjustment of the magnetic system are also examined, and the results are given of an investigation into the instrument's magnetic surfaces. Computations worked out on an electronic computer for the design of the magnetic system are described, and differences between the "Uragan" and the "Sirius" stellarators are indicated. A comparative table of the parameters for various types of stellarator is given; it shows that the "Uragan" is one of the more powerful thermonuclear machines, with a high shear value for its substantial 10 kOe magnetic field intensity. (JPRS)

9386 OUTLOOK FOR FISSION AND FUSION NUCLEAR ENERGY. Considerations on the Associated Risks. Breton, D. (CEN de Saclay, Gif-sur-Yvette, France). Ann. Mines; No. 1, 95-104(Jan 1974). (In French).

The two ways envisaged for the industrial exploitation of nuclear fusion are considered: magnetic confinement and thermonuclear microexplosion. The problem of a possible sudden release of energy from both fission and fusion reactors is discussed together with that of radioactive wastes. The latter problem hardly occurs with fusion reactors. (FR)

9387 SHELL-LESS TOKAMAK NOVA. Fuko, M. (Kyoto Univ.); Momota, H.; Kubo, H.; Oshiyama, H.; Nakamura, S. Mem. Fac. Eng., Kyoto Univ.; 35: No. 3, 297-308(Jul 1973).

A description is given of the experimental shell-less Tokamak NOVA. This apparatus is designed to investigate the stabilization of plasmas in a shell-less Tokamak device, first by the program- and the feedback-control of the vertical magnetic field, and then by controlling the radial distribution of the longitudinal plasma current. The basic concepts of design and the constructional data of the principal components are shown, together with some results of preliminary experiments. (auth)

9388 ALLOWANCE FOR THE ROLE OF IONS IN CALCULATING THE SCREENING EFFECT ON THERMONUCLEAR REACTIONS. Redkoborodii, Yu. N. Astrometriya Astrofiz.; No. 19, 81-87(1973). (In Russian).

The contribution of ion nuclei to the screening effect in thermonuclear reactions, and the possibility of allowing for this contribution within the framework of Porfiriev and Redkoborodyi's (1969) theory are described. It is shown that the ion contribution can be accounted for through introduction of the effective dielectric constant in the expressions for the screening effect. (IAA)

9389 EFFECT OF HIGH-Z IMPURITIES ON THE IGNITION AND LAWSON CONDITIONS FOR A THERMONUCLEAR REACTOR. Meade, D. M. (Princeton Univ., NJ). Nucl. Fusion; 14: No. 2, 289-291(Apr 1974).

The ignition condition for a steady-state homogeneous D–T reactor is given by $\frac{3}{2}\ (n_e kT_e + \Sigma_i n_i kT_i) = (\langle\sigma v\rangle\ U_\alpha n_D n_T - P_{rad})\ \tau$ where it is assumed that the plasma is quasi-neutral, all plasma constituents have the same temperature T, the deuteron and triton densities are equal and $\langle\sigma v\rangle$ is the D–T thermonuclear reaction rate averaged over a Maxwellian energy distribution. The impurity concentration, fn_e, is assumed to consist of a single species of atomic number Z_N which is ionized Z times. The radiated power is given by $P_{rad} = R(f, Z, T)n_e^2$ and includes free–free bremsstrahlung, free-bound bremsstrahlung (recombination) and line radiation. The alpha particle is assumed to transfer all of its initial energy to the plasma, therefore $U_\alpha = 3.52$ MeV. The energy confinement time τ accounts for energy losses due to particle losses and thermal conduction. Diagrams showing ignition conditions and Lawson criteria are given. (MOW)

9390 CROSS-SECTION SENSITIVITY OF TRITIUM BREEDING IN A FUSION REACTOR BLANKET: EFFECTS OF UNCERTAINTIES IN CROSS-SECTIONS OF ^{6}Li, ^{7}Li, AND ^{93}Nb. Steiner, D.; Tobias, M. (Oak Ridge National Lab., TN). Nucl. Fusion; 14: No. 2, 153-163(Apr 1974).

The cross-section sensitivity of the tritium-breeding ratio was investigated in a fusion reactor blanket model which is representative of a large class of blanket configurations under current investigation. This blanket model exhibits the following tritium-breeding and neutronic characteristics: (1) liquid lithium of natural isotopic abundance is used for breeding; (2) the tritium-breeding ratio is in the "high" range, ~1.5; (3) graphite is employed for neutron moderation; and (4) the neutron leakage from the blanket is relatively low, ~4% of the source neutrons. The sensitivity of the breeding ratio was evaluated by altering reference cross-section sets to reflect estimates of the uncertainties in the cross-section of the ^{6}Li(n,α)t, the ^{7}Li(n,n'α)t, and the ^{93}Nb(n,2n) reactions. (auth)

Wave Phenomena

Refer also to abstracts 9324, 9329, and 9351.

9391 (AD-771718) THEORY OF MICROWAVE EMISSION BY VELOCITY-SPACE INSTABILITIES OF AN INTENSE RELATIVISTIC ELECTRON BEAM. Ott, E.; Manheimer, W. M. (Naval Research Lab., Washington, D. C. (USA)). Dec 1973. 24p. (NRL-MR-2687). NTIS $3.25.

The stability of waveguide modes in a waveguide along which is propagated an unneutralized, intense beam of relativistic electrons guided by an applied axial magnetic field is considered. It is found that the waveguide mode can interact unstably with the beam by resonating with the Doppler shifted cyclotron frequency of the beam. This instability appears to be the mechanism by which microwaves are produced in some recent experiments which are discussed. (auth)

9392 (CLM-R-131) PROPAGATION OF SMALL AMPLITUDE COHERENT ELECTRON PLASMA WAVES IN Q-MACHINE PLASMA. Franklin, R. N.; Hamberger, S. M.; Lampis, G.; Smith, G. J. (UKAEA Research Group, Abingdon. Culham Lab.). Jan 1974. 41p. Dep. NTIS (US Sales Only) $5.00.

This report is intended to contain the essential practical details necessary to make reliable measurements of the propagation constants of small amplitude (linear), monochromatic, electron plasma waves and show how they are used to determine with high precision the electron number density and temperature. Data obtained in the Culham Q-machine (ARIADNE) in which an almost collisionless, thermally ionized, strongly magnetized cylindrical plasma column is produced were used. (auth)

9393 (IPF–72-8) SELECTED EXAMPLES OF WAVE PROPAGATION IN INHOMOGENEOUS PLASMAS. Raeuchle, E. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). 1972. 112p. (In German). INIS.

A procedure for the solution of the coupled linear homogeneous differential equations was developed allowing the calculation of eigenvalues and eigenstates. By means of the numerical method, typical examples of wave propagation in inhomogeneous plasmas are treated which can not be solved analytically. The eigenfrequencies and eigenstates for high-frequency waves in cylindrical resonators partially filled with plasma are solved in order to apply these to the appropriate problems in plasma diagnostics and plasma heating by microwaves. The method is also valid for radially inhomogeneous plasma parameters. The numerical procedure for complex calculations also takes into account dissipative effects. The numerical solution of low-frequency waves in diffusion-controlled positive columns in a magnetic field shows some discrepancies with the results by the usual methods for relatively short wavelengths. The radial distribution of density and potential waves depends on plasma and wave parameters. The eigenstates for azimuthal and radial orders of m = 2 result in a complicated stability behavior at short wavelength. This means that m = 2 wave may be unstable in magnetic field ranges where the m = 1 waves are stable. (GE)

9394 (IPP-1-138) DYNAMICS OF TOROIDAL HIGH-β STELLARATORS. Neuhauser, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Dec 1973. 27p. Dep. NTIS (US Sales Only) $4.50.

The influence of plasma dynamics in toroidal high-beta Stellarators was investigated in an idealized, linear model (incompressible, sharp boundary) with artificial force of gravity instead of the toroidal drift force. The dynamic interference force produced by the coupling of oscillating l = 1 and l = 2 stellarator fields was calculated for frequencies near the resonance frequency of the helical modes. A simple interpretation of the frequency response is given and the influence of damping and compressibility is discussed. The result is used to explain the initial dynamics in the ISAR T 1 experiment and to estimate the effect of plasma heating by helical Alfvén waves on plasma stability. (auth)

9395 (JPRS-61956) STUDY OF THE STRUCTURE OF A THERMONUCLEAR COMBUSTION FRONT IN A LAYER OF PLASMA CONFINED BY PHYSICAL WALLS. Nastoyashchii, A. F.; Shevchenko, L. P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1972. Translation of IAE-2180. 34p. NTIS.

Data are presented on the conditions for the existence, the speed of propagation, and the structure of the combustion front

of a thermonuclear wave in an infinite layer of plasma confined by heavy physical walls. Matching of approximate analytical solutions for hot and cold plasma, phase plane techniques, and numerical methods are used in the investigation. (auth)

9396 (KFTI-73-1) MATHEMATICAL STATISTICS METHODS FOR INVESTIGATION OF PLASMA-BEAM INTERACTIONS. Collected Programs. Part 1. Zeidlits, V. P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1973. 16p. (In Russian). INIS.

The study of oscillations excited as a result of the interaction of a sufficiently intensive electron beam with a plasma by ordinary methods is a difficult problem. This study presents the basic relations on the basis of which a program is written in machine language "DNEPR", from which it is possible to obtain information on the time behavior of the frequency, phase and amplitude of oscillations under study and also to determine the space-time correlation function, the spectral energy density of the oscillations for various k, ω, the coherence function, etc. (SJR)

9397 (NP-20008) NONLINEAR ION-ACOUSTIC OSCILLATIONS IN NON-ISOTHERMAL PLASMA WITH CURRENTS NEAR THE INSTABILITY THRESHOLD. Abu-Asali, E.; Al'terkop, B. A.; Rukhadze, A. A. (AN SSSR, Moscow. Fizicheskij Inst.). 1973. 43p. (In Russian). Dep. NTIS (US Sales Only) $5.25.

The presently existing values on the linear theory of the excitation of space and surface ion-acoustic oscillation by electrical currents in plasma are systematized. The threshold for the origin of the instabilities is determined and an explanation is given of the excitation of such modes of oscillation. The instabilities near the threshold are traced from the nonlinear development when the excitation of one mode of oscillation occurs. (tr-auth)

9398 HYDRODYNAMIC EXCITATION OF LOW-FREQUENCY WAVES IN A CONFINED LOW-TEMPERATURE PLASMA WITH ELECTRON OR ION BEAMS. Zhelyazkov, I.; Nenovski, P. God. Sofii. Univ., Fiz. Fak.; 65: 105-115(1970). (In Bulgarian).

The excitation of low-frequency surface waves in a confined plane-parallel plasma by electron or ion beams was studied. Two cases were examined: (1) cold beams passing through the plasma layer bounded by a vacuum and (2) a cold beam passing through the vacuum layer bounded by the low-temperature plasma. The increments for the oscillation buildup were found and it was shown that the exciting instabilities are convective. The conditions which are superposed on the concentration of the particles of the beam for excitation of the surface waves in the beam-plasma system are indicated. (tr-auth)

9399 BEAM-PLASMA WAVES FROM A FINITE-LENGTH PLASMA. Roberson, C.W.; Fukai, J. (Department of Engineering and Applied Science, Yale University, New Haven, Connecticut 06520). J. Appl. Phys. 45: No. 6, 2489-2492 (June 1974).

By inserting a grid in a beam-generated plasma column, single waves can be produced as a result of the beam-plasma instability exciting a finite-length cavity mode. The oscillation frequency is found to increase with beam velocity, in contrast to the frequency-velocity relationship of the wave with the maximum growth rate. The nonlinear evolution of the beam-generated wave and satellites due to a test wave are observed. (auth)

9400 WAVE CONVERSION IN STRATIFIED MEDIA WITH HYPERBOLIC-TANGENT NONUNIFORMITIES. Doane, J.L. (Bell Telephone Laboratories, Murray Hill, New Jersey 07974). J. Appl. Phys. 45: No. 6, 2748-2758 (June 1974).

A systematic procedure is developed for finding analytical solutions of certain ordinary linear differential equations of arbitrary order, describing reflection and conversion of waves in multiwave media having a concentrated region of nonuniformity. This procedure involves transformation to equations solvable by generalized hypergeometric functions which have the form of normal modes, exp(-ikz), in uniform regions. It is applicable when the variable coefficients in the original equation contain only linear combinations of one varying parameter, p(z), and in certain cases its derivatives or ratios thereof, if p(z) is proportional to tanhz. Arbitrary gradients and dissipation are allowed. The applicability of this procedure to solve for the reflection and conversion coefficients is indicated for second-, fourth-, and sixth-order problems in magnetostatic, spin, and elastic-wave conversion in magnetic insulators such as ytirium iron garnet, and for electromagnetic-to-electrostatic wave conversion in hot plasmas. Some of these problems involve fourth-order singular turning points formed by the coalescence of resonance and cutoff. Explicit expressions for the reflection and conversion coefficients are given for fourth-order systems in terms of Γ functions of complex arguments. In the absence of dissipation, the absolute magnitude of these coefficients may be expressed in terms of ordinary transcendental functions. (auth)

9401 DECAY OF A PLASMON INTO TWO ELECTROMAGNETIC WAVES. Hasegawa, A. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. Lett. 32: No. 15, 817-820 (15 Apr 1974).

In a plasma with a magnetic field, a plasmon can decay into two electromagnetic waves: a left-hand-polarized electromagnetic wave and a right-hand-polarized whistler wave, both propagating in the direction of the magnetic field. Use of this process for a plasma laser is discussed. (auth)

9402 EXCITATION OF PURE ELECTRON PLASMA WAVES BY MODULATED ELECTRON BEAMS. Ohnuma, T.; Ohnuki, S.; Fujita, T.; Adachi, S. (Department of Electrical Engineering, Tohoku University, Sendai, Japan). Phys. Rev. Lett. 32: No. 15, 820-823 (15 Apr 1974).

A new type of exciter consisting of electron beams for launching electron plasma waves is investigated experimentally and theoretically. When fast electron sheet beams, modulated at a prescribed frequency, are injected into plasmas, electron plasma waves are found to be excited nearly perpendicularly to the electron beams. Compared with a mesh excitation, we found that the beam excitation has several merits: it hardly excites ballistic modes, the direct coupling due to an electrostatic induction with another probe is small, and it can even be used in a very hot plasma. (auth)

9403 PARAMETRIC EXCITATION OF WAVES IN ISOMETRIC PLASMA. Sturman, B. I. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 157-159(1974). (In Russian).

It was shown that a simplified description of the plasma, based on fast time averaging of ω_{pe} (plasma electron frequency), contains all kinetic effects. The dispersion equation obtained on this basis was applied to the study of the instabilities of isothermal plasma. It was shown that at $T_e \sim T_i$ both thresholds are comparable. The increments of the decay instabilities were determined in this region. (tr-auth)

9404 OPTIMIZATION OF COMPRESSION CONSTANTS FOR CUMULATED PLANE SHOCK WAVES IN A CLOSED TUBE. Kaliski, S.; Wlodarczyk, E. (Instytut Podstawowych Problemow Techniki, Warsaw). Proc. Vib. Probl.; 14: No. 2, 117-135(1973).

Criteria are described for optimal compression of a gas by plane waves arising from the motion of a piston in a closed, nondeformable cylindrical tube. It is shown that optimum compression effects occur at the bottom of the tube in the case of isentropic compression of the gas. Isentropic compression provides substantially higher values of the density (higher compression) than in the case of compression by shock waves which produce heating of the gas, thus counteracting the compression process. (IAA)

9405 TRANSFORMATION OF SHOCK COMPRESSION INTO ISENTROPIC COMPRESSION IN A NONHOMOGENEOUS BODY. Kaliski, S. (Instytut Podstawowych Problemow Techniki, Warsaw). Proc. Vib. Probl.; 14: No. 2, 137-144(1973).

Using a simplified model for the propagation of a shock wave in a nonhomogeneous medium (gas) with increasing density, it is shown that the intensity of a plane shock wave decreases to zero at the wavefront in the presence of constant external pressure in spite of the fact that compression increases. In other words, shock compression under constant external pressure is transformed into isentropic compression. Solutions of the compression problem are obtained in the form of closed analytical expressions, and the results are significant for research on laser heating and compression of plasmas in view of the fact that the effects of isentropic compression are greater than those of shock compression. (IAA)

9406 SCATTERING OF ELECTROMAGNETIC WAVES IN PLASMAS DUE TO INTERMITTENCE TURBULENCE EFFECT. Sharma, S. C. (Birla Inst. of Science and Tech., Pilani, India). Contract AT(11-1)-3073. Indian J. Pure Appl. Phys.; 11: No. 12, 869-872(Dec 1973).

The effect of turbulence-intermittence on the scattering of electromagnetic waves by plasmas was discussed, on the basis of earlier theoretical analysis. The characteristics of the scattering cross section with its aspect angle and frequency dependence are found to be significantly modified when the intermittence effects are considered. The scattering cross section is calculated and illustrated with and without intermittency effects in different situations. (auth)

9407 EXCITATION OF ELECTROSTATIC PLASMA TURBULENCE BY A MAGNETO-ACOUSTIC WAVE. Harms, K. D.; Hasselberg, G.; Rogister, A. (Kernforschungsanlage, Juelich, Ger.). Nucl. Fusion; 14: No. 2, 251-262(Apr 1974).

An integral equation which generalizes the dispersion relation for electrostatic plasma modes with wave numbers $\vec{k}$ in the presence of a large-scale magnetoacoustic (pump) oscillation is derived. This calculation is accurate to all orders in the parameter

$\vec{k} \cdot \vec{D}$ where $\vec{D}$ is the amplitude of the particle displacement induced by the pump wave. Expanding in the latter parameter, one obtains a second-order differential equation including three-wave processes, nonlinear frequency shifts and nonlinear Landau damping. The electromagnetic wave may disintegrate into two Bernstein waves (three-wave interaction) if the appropriate resonance condition (between the real parts of the frequencies) can be satisfied approximately. However, a Bernstein wave can still be excited when the resonance condition is not fulfilled. In the latter case, instability arises through inverse nonlinear Landau damping, and the nonlinear dispersion relation can be approximated, to a high degree of accuracy, by a three-by-three matrix. In the former case, the dispersion relation reduces, to a good approximation, to the standard two-by-two matrix only if the linear decrements of both electrostatic waves are sufficiently small; otherwise, the three-wave process identifies with the nonlinear Landau instability calculated in the appropriate limit (of matching between the real parts of the frequencies). The relative importance of resonant and off-resonant coupling of the pump wave to the plasma is discussed. (auth)

9408 TRANSILLUMINATION OF THE WAVE BARRIERS IN A PLASMA AS A RESULT OF KINETIC EFFECTS. Vodyanitskii, A. A.; Erokhin, N. S.; Lisitchenko, V. V.; Moiseev, S. S.; Oraevskii, V. N. (Inst. of Nuclear Research, Kiev). Nucl. Fusion; 14: No. 2, 267-275(Apr 1974).

The influence of kinetic effects on wave propagation in an inhomogeneous plasma is considered. It is shown that effects such as phase focusing of particles by an inhomogeneity, perturbation transfer by resonance electrons and echo phenomena can lead to a substantial increase in plasma transparency. (auth)

9409 PARAMETRIC EXCITATION OF ION-ACOUSTIC WAVES IN A MAGNETOPLASMA IN A HIGH-FREQUENCY ELECTRIC FIELD. Kitsenko, A.B.; Stepanov, K.N. Sov. Phys.-Tech. Phys. 18: No. 7, 902-904 (Jan 1974).

Parametric excitation of fast and slow ion-acoustic waves is analyzed in a strongly nonisothermal plasma in a high-frequency electric field parallel to the magnetic field. (auth)

9410 ABSORPTION OF WAVES BY A PLASMA WITH A NONMONOTONIC LONGITUDINAL DENSITY DISTRIBUTION. Arkhipenko, V.I.; Budnikov, V.N.; Obukhov, A.A. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). Sov. Phys.-Tech. Phys. 18: No. 7, 933-935 (Jan 1974).

An experiment investigating the absorption of waves of frequency $\omega_{H_e} > \omega > \sqrt{\omega_{H_e}\omega_{H_i}}$ by a specially prepared plasma having a minimum in its longitudinal density distribution is reported. The experiment is carried out in an argon plasma at a pressure of 10^{-2} torr, at a working frequency $\omega = 975$ MHz, and with $\omega_{H_e}/\omega = 9.4$. It is shown that there exists a region of absorption for large densities $n \geq n_c$. The limiting value of the density satisfactorily matches the theoretical limit of the region of wave conversion, calculated for a plasma, the parameters of which are those obtained in the experiments. (auth)

ENGINEERING

Energy Conversion

Refer also to abstract 9377.

9411 (AD-771581) INVESTIGATION IN ENERGY TRANSFER AND ENERGY CONVERSION FOR ADVANCED POWER AND PROPULSION SYSTEMS. Final Report, March 16, 1970–March 16, 1973. Calvert, C.; Watson, J. (Systems Research Labs., Inc., Dayton, Ohio (USA)). Oct 1973. Contract F33615-70-C1515. 120p. (ARL-73-122). NTIS $4.25.

Work done in three areas of energy conversion and transfer involving fluid dynamic processes is described, i.e., electrofluiddynamic energy conversion, multicomponent flow research, and aerodynamic energy transfer research. The effort under item one was an exploration of direct energy conversion of fluid dynamic energy into electrical power using electrofluiddynamic (EFD) processes. The objective here was to identify workable and practical processes and designs for superior, lightweight, reliable, electrical generators. Item two covers studies of methods by which heat energy from reactions of solid particles or droplets contained in a combustion or reaction chamber can be used to produce fluid dynamic energy. The principal objective of this work was to assess wall erosion, particle suspension, and related fluid dynamic processes and components germane to practical thrust augmentation ejectors. The objective was to identify appropriate design concepts applicable to future vertical or short-field take-off-and-landing aircraft. (auth)

9412 (IAE-2262) EFFECT OF TURBULENT BOUNDARY LAYER ON THE FARADAY MHD GENERATOR WITH THE SOLID ELECTRODES. Breev, V. V.; Gubarev, A. V.; Panchenko, V. P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1972. 16p. (In Russian). INIS.

It is known that detachment of the boundary layer in a MHD-channel leads to a substantial decrease in yield characteristics of a MHD-generator. This study presents calculations on various modes of flow in a MHD-channel having continuous electrodes (flow of T, p, U = constant; and linear channels with various angles of exposure) with the development and detachment of a turbulent boundary layer being taken into account. It is shown that the limiting characteristics (coefficient of energy conversion and others) of the MHD-generator can be restricted by detachment of the boundary layer. Consideration is given to the problem of constructing a profile of the MHD-channel which assures a flow with detachment of the boundary layer and high values of the energy conversion coefficient. A formulation is given for the variational problem of selecting an optimal MHD-generator with development of a boundary layer and the restriction associated with its detachment being taken into account. A method is pointed out for going from the variational problem to the problem of a conditional extremum of a function of many variables, for the solution of which a projected gradient method is proposed. (SJR)

9413 (JUL-984-TP) DESIGN OF A MHD SADDLE MAGNET FOR THE PROJECT VEGAS II. Kolb, G.; Komarek, P. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Technische Physik). Jul 1973. 65p. (In German). Dep. NTIS (US Sales Only) $6.25.

A description is given of the design of an MHD saddle magnet for a central magnetic induction of 5 T, a homogeneous magnetic field length of 2 m, and a cylindrical space of 60 cm in diameter, with the cylinder axis in parallel with the direction of the plasma current. The cylindrical space is accessible at room temperature. (GE)

9414 (N-74-14785) IMPINGING JET SEPARATORS FOR LIQUID METAL MAGNETOHYDRODYNAMIC POWER CYCLES. Bogdanoff, D. W. (Jet Propulsion Lab., Pasadena, Calif. (USA)). 1 Dec 1973. Contract NAS7-100. 155p. (NASA-CR-136552; JPL-TM-33-621). NTIS $9.75.

In many liquid metal MHD power cycles, it is necessary to separate the phases of a high-speed liquid-gas flow. The usual method is to impinge the jet at a glancing angle against a solid surface. These surface separators achieve good separation of the two phases at a cost of a large velocity loss due to friction at the separator surface. Attempts to greatly reduce the friction loss by impinging two jets against each other are described. In the crude impinging jet separators tested to date, friction losses were greatly reduced, but the separation of the two phases was found to be much poorer than that achievable with surface separators. Analyses are presented which show many lines of attack (mainly changes in separator geometry which should yield much better separation for impinging jet separators). (STAR)

9415 THERMOELECTRIC POWER AND ELECTRICAL RESISTIVITY OF SOME Ni-BASED ALLOYS NEAR THE CURIE POINT. Nagy, I.; Pal, L. (Central Research Inst. for Physics, Budapest). Acta Phys. Acad. Sci. Hung.; 35: No. 1-4, 99-104 (1974).

The anomalous behavior of the absolute thermoelectric power (ATP) near the critical point was investigated in Ni and its dilute alloys with some 3d transition elements. Both the ATP and the temperature coefficient of the electrical resistivity (TCER) in the vicinity of the Curie point were measured in Ni(Fe), Ni(Mn) and Ni(Cr) alloys with different impurity concentrations. It was found that the critical behavior of the transport properties depends strongly on the impurity. In Ni(Mn) alloys an oscillatory behavior of the ATP was observed around the Curie point, while there was also a very significant difference in the critical behavior of the TCER from that in pure Ni, Fe, and Cr impurities, on the other hand, did not alter the monotonous temperature dependence of the ATP at the Curie point, and the singularity of the TCER did not differ from that in pure Ni. It is suggested that the peculiar behavior of Ni(Mn) alloys originates from virtual bound states near the Fermi level, since a shift of the Fermi level at the Curie temperature could drastically change the density of states at the Fermi energy and this might account for the observed anomalies of the transport properties. (auth)

9416 CALCULATION OF TWO-DIMENSION ELECTRICAL FIELDS IN CHANNELS OF MAGNETOHYDRODYNAMIC INSTALLATIONS. But, D. K.; Kovalev, L. K.; Nikitin, Yu. M.; Nikitina, I. A. Zh. Prikl. Mekh. Tekh. Fiz.; No. 2, 8-16(1974). (In Russian).

Local and integral characteristics of two-dimensional MHD channels were studied with a consideration of the longitudinal and transverse fringe effects and the inhomogeneities in the distribution of the conductivity and flow rate. An analysis was made of the effect of the finite dimensions of the installation during the fringe effect and of the modular construction of the side walls in transverse fringe effect on the output parameters of the MHD channel. The solution is based on a knowledge of the original quasilinear elliptical equations for the energy potential with a consideration of Ohm's law in the Friedholm-type integral equations on the current density. (tr-auth)

9417 STATUS AND PROSPECTS OF MHD POWER PLANTS. Messerle, H. K. (Univ., Stuttgart). Atomwirt., Atomtech.; 19: No. 2, 66-69(Feb 1974). (In German).

A brief survey is given of the history, development, purposes, results and prospects of research work on MHD conversion systems and generation systems (particularly of the investigations carried out in the USSR and the USA). The most important experimental MHD plants of the world are shown in a table, and open and closed-cycle (gas and liquid metal) MHD conversion systems are briefly described, giving the heating temperatures and efficiency data achieved so far. (GE)

9418 BURNER MEANS FOR THERMOELECTRIC GENERATOR. Pitcher, E. W.; Nystrom, T. L. (to Minnesota Mining and Mfg. Co.). US Patent 3,808,056. 30 Apr 1974. Filed date 22 Feb 1973. 8p.

An improved burner assembly is described to heat a thermoelectric generator, comprising an ultrasonic atomizer for atomizing liquid fossil fuels into a mist of fine particles; baffle means for causing an appropriate mixture of fuel and air; and, usually, a mantle for uniformly distributing the heat of combustion over a cylindrical hot plate against which thermoelectric legs are disposed. (Official Gazette)

9419 SMALL ELECTRICAL POWER SOURCES. Penn, A. W. (UKAEA, Research Group, Harwell, Eng.). Phys. Technol.; 5: No. 2, 115-140(1974).

The criteria of portability and long life, when applied to limit the field of small batteries, result in the elimination of all but solar, chemical and nuclear prime energy sources. The theory, present state of the art, and future prospects for batteries delivering up to a few kilowatts from these prime sources are outlined. In considering nuclear converters, which include thermoelectric, thermionic, betavoltaic and the Stirling, Rankine and Brayton cycles, consideration is given not only to the possible isotopes but also to the safety aspects of the designs. The inherent simplicity of the fuel cell is outlined in the theory and contrasted in the practical realization where, unlike the solar cells described, the control systems required have resulted in a slowing of progress. (auth)

9420 MEANS AND METHOD OF PROCESSING RESERVOIR-LESS THERMIONIC CONVERTERS. De Stesse, J. G.; Bowey, R. E. (to McDonnell Douglas Corp.). US Patent 3,807,827. 30 Apr 1974. Filed date 15 Nov 1971. 12p.

A low temperature radioisotopic thermionic converter having a construction wherein the converter adsorption area to vapor volume ratio is sufficiently high at the converter's operating pressure to achieve an area-dominated adsorption effect structure, is processed by first refluxing cesium at high collector temperature and high vapor pressure in the converter to purge remanent reactive impurities therein and then establishing the loci of converter maximum power versus cesium reservoir temperature for respectively different collector temperatures to allow adjustment of the converter at optimum cesium pressure and optimum collector temperature before sealing is described. Cesiation apparatus for batch-charging of a plurality of converters from a common cesium supply source includes a heated cesium reservoir container for enclosing the converters therein, and a collector heater, emitter and collector connection leads, and a means of sealing each converter at each converter position. (Official Gazette)

Facilities and Equipment

Refer also to abstract 9706.

9421 (HWS-10006) HANFORD STANDARD: DESIGN CRITERIA. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 1974. 169p. Dep. NTIS $11.50.

Codes and standards for structures used at the Hanford Plant are presented. They include architectural structures, underground water lines, railroads, heating systems, ventilation systems, air conditioning systems, inside and outside lighting and power systems, underground power lines, communication systems, fire alarm systems, noise control, and corrosion protection. (TFD)

9422 (ISD-104) CALCULATIONS FOR PRESTRESSED CONCRETE PRESSURE VESSELS. Argyris, J. H.; Willam, K. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen). Jul 1971. 46p. (In German). INIS.

Various approaches for the calculation and analysis of prestressed concrete vessels are described. Analytical methods, finite difference methods, and finite element methods are briefly discussed and their theoretical principles are summarized. All calculating methods have a number of error sources which more or less influence the results. There are three criteria to classify the various error sources that are present in every numerical solution, i.e., errors in idealization, in discretization, and numerical errors. The various calculation methods are examined with a view to these error sources and compared to each other. (GE)

9423 (LA-UR-74-212) PERFORMANCE TESTS OF GRAVITY-ASSIST HEAT PIPES WITH SCREEN-WICK STRUCTURES. Kemme, J. E.; Deverall, J. E.; Keddy, E. S.; Phillips, J. R.; Ranken, W. A. (Los Alamos Scientific Lab., N. Mex (USA)). 1973. 15p. (CONF-740705-1). Dep. NTIS $4.00.

From thermophysics and heat transfer conference; Boston, Massachusetts, USA (15 Jul 1974).

The equipment and procedures used in the performance testing of sodium heat pipes operating in the gravity-assist mode are described. These tests showed that superheat limitations are a major factor to be overcome in wick design and wick fabrication methods. Oversize voids adjacent to the heat-pipe wall tend to become the loci of vapor pockets which block heat transfer through the wick and seriously reduce performance, particularly at relatively high working-fluid vapor pressures. In general, wick imperfections, which may be inconsequential or even beneficial under gravity-neutral operating conditions, are likely to have a performance-limiting effect for gravity-assist operation. Some of the tests also indicate that the performance of gravity-assist heat pipes may be limited by interactions between vapor and liquid. Tests are now being conducted with helical baffles which should provide protected flow paths of low impedance for the returning liquid. (LCL)

9424 (NP-20013) PHYSICS OF LASERS (No. II: ELEMENTS OF THERMODYNAMICS AND STATISTICAL PHYSICS). Ionescu-Pallas, N. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 76p. (In Rumanian). Dep. NTIS (US Sales Only) $7.00.

9425 (RD/B/N-2734) GAS LEAKAGE FROM STATIC SEALS. Chivers, T. C.; Williams, M. E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1973. 44p. Dep. NTIS (US Sales Only) $5.25.

Gas losses past static seals are considered by treating the flow as being through discrete paths. By considering the size and probable deformation of surface asperities together with the dynamics of the leakage flow it is argued that losses should be predominantly in a laminar flow regime. While it has not been possible to determine the precise nature of leakage paths, a large number of flow experiments with carbon dioxide and helium are reported which confirm the theoretical predictions. The results provide a basis for proving the leak tightness of vessels using gases other than the operating one. (auth)

9426 (TID-26577) HANFORD DRAFTING PRACTICE MANUAL. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 1973. 75p. Dep. NTIS $6.75.

Codes and standards for the preparation of engineering drawings at the Hanford Plant are presented. (TFD)

9427 (UCID-16499) LASER DISC COMPUTER SIMULATION. Sonderman, J. B.; Glassman, A. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 May 1974. Contract W-7405-eng-48. 21p. Dep. NTIS $4.25.

An evaluation of an eight disc laser amplifier was made. One of the tests consisted of a wavefront distortion test of the entire assembly using a Mach Zehnder interferometer. Later it was decided to use a computer program to model this same experiment. The POLYPAGOS lens evaluation program was chosen. The objective was to analytically determine the wavefront distortion of a laser beam passing through a series of eight discs with specified surface figures, and compare the data with experimental results. (MOW)

9428 (UCRL-75476) NEW RARE EARTH QUANTUM ELECTRONIC DEVICES: A CALCULATIONAL APPROACH. Krupke, W. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1974. 43p. (CONF-740404-2). Dep. NTIS $5.25.

From region 6 conference; Albuquerque, New Mexico, USA (24 Apr 1974).

The phenomenological models of radiative and nonradiative transition probabilities in rare earth doped solids are reviewed and the present phenomenological data base is summarized. A general computational methodology for the prediction of new laser and other quantum electronic devices is outlined. Specific examples of CW and "radiation switched" lasers are given to illustrate the technique and to identify gaps in the data base. (auth)

9429 APPARATUS FOR SHEARING SPENT NUCLEAR FUEL BUNDLES. Ehrman, C. S.; Scheib, L.; Worsley, C. S.; Jones, F. J.; Freeborg, R. M. (to Allied Chemical Corp.). US Patent 3,807,018. 30 Apr 1974. Filed date 6 Jul 1972. 10p.

An apparatus is described for shearing long units, such as nuclear fuel bundles, into pieces of predetermined length for further processing comprising a sealable magazine for receiving the bundles, means for urging the bundle forward, a vertical and horizontal gag, or alternately two parallel-acting horizontal gags operated in conjunction with a vertical restraint, for compressing the front portion of the bundle, and a shear blade adjacent to the gags, whereby the nuclear fuel bundle may be urged forward in increments, compressed and sheared into pieces. (Official Gazette)

9430 LAW OF THE ENERGY CONSERVATION IN FLOW LASERS. Puzewicz, Z.; Trzesowski, Z. (Military Academy of Tech., Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 2, 141-147(Mar 1974).

The output characteristics of quantum flow lasers with a forced flow-stream was analyzed. Correct results were obtained and it was shown that the relations developed earlier are in disagreement with the fundamental law of physics, the law of the energy conservation. (auth)

Heat Transfer and Fluid Flow

Refer also to abstracts 9423, 11483, 11810–11813, 11827, 11843–11845, 11847, 11850, 11874–11882, 11884–11886, 11915, 11930, 11984, 11997, 12012, and 12021–12023.

9431 HANDBOOK OF HEAT TRANSFER. Rohsenow, W. M.; Hartnett, J. P. (eds.). New York; McGraw-Hill Book Company (1973). 1518p. $39.50.

A comprehensive reference book of current heat transfer technology is presented which was compiled from the writings of heat transfer specialists in the following subject areas: basic concepts of heat transfer; thermophysical properties of materials; solution of heat conduction problems by mathematics and analog methods; forced convection with internal and external flows; effects of electric and magnetic fields on heat transfer; heat transfer between

surfaces and rarefied gases; film and drop-wise condensation; boiling and two-phase flow; radiant heat transfer; mass transfer in stationary and convective systems; effects of ablation; high-temperature protection systems; methods for augmenting convective heat transfer; and heat exchanger design. (LCL)

9432 EFFECT OF GAS BUBBLES ON LIQUID METAL HEAT TRANSFER. Winterton, R. H. S. (Birmingham Univ., Eng.). Int. J. Heat Mass Transfer; 17: No. 5, 549-554(May 1974).

A theory was developed for heat transfer to liquid metals when the heat transfer surface is covered with gas bubbles. The system analyzed is that of constant heat flux to slug flow in a circular pipe. The effective Nusselt number depends upon the thickness of the layer of bubbles and its thermal conductivity. A method of calculating these quantities for systems where the contact angle is less than about 60° is described. A number of previously unexplained experimental results can be understood in terms of this theory. (auth)

9433 RESULTS OF A NUMERICAL SIMULATION OF TURBULENT CHANNEL FLOWS. Schumann, U. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). pp 230-251 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

Results are reported of a direct numerical simulation of incompressible turbulent channel flows in a plane channel and an annulus. The results were obtained by means of a finite difference scheme for the direct integration of the Navier–Stokes equations together with some fine scale models which takes into account the motion which cannot be resolved by finite grids. The results are generally in good agreement with experimental data. It is shown that the solutions may be used to evaluate constants of turbulence models and to test their universality. For some examples it has been shown that the "constants" are not independent of the cross stream position. Here the replacement of the constants by some functions may help to refine those turbulence models which consist of a small number of transport equations. The results are virtually independent of the number of grid volumes employed. This indicates that the turbulence model terms considered are determined mainly by the resolved gross scale structure of the turbulent flows. (auth)

9434 HYSTERESIS EFFECTS AND HYDRODYNAMIC OSCILLATIONS IN INCIPIENT BOILING OF FREON 11. Abdelmessih, A. H.; Yin, S. T.; Fakhri, A. (Univ. of Toronto). pp 331-350 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

Experimental results on the following phenomena in the transition boiling region of Freon II in a forced convection system are presented: incipient boiling superheat, hysteresis effects in heat transfer coefficients, and hydrodynamic instabilities. It was found that incipient boiling superheat is required for the initiation of surface boiling; that hysteresis effects are pronounced in the transition region between forced convection and fully developed nucleate boiling, and finally, the knee of the boiling curve is found to be hydrodynamically unstable and is liable to boiling oscillations when operated with a forced circulation system. (RCK)

9435 BOILING FLOW INSTABILITIES IN A FOUR PARALLEL-CHANNEL UPFLOW SYSTEM. Kakac, S.; Veziroglu, T. N.; Aksu, H. B.; Alp, Y. (Middle East Technical Univ., Ankara, Turkey). pp 404-420 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

The instabilities in a four parallel channel boiling upflow system have been experimentally investigated using Freon-11 as the test fluid. Two major modes of the oscillations, namely density-wave and pressure-drop oscillations, similar to those encountered in single-channel boiling flows, have been identified. In most instances, some temperature oscillations were observed at the downstream ends of the heaters. The periods and amplitudes of the oscillations have been correlated with the flow parameters, such as mass flow rates, heat inputs and exit qualities. Transient oscillations resulting from a step increase in power input and a step decrease in flow rate have also been investigated. It has been found that such step changes caused steady increases in wall temperatures when working in stable region, damped oscillations near the stability boundary, and oscillations having asymptotically decreasing amplitudes towards limit-cycle oscillations when the system operated in the unstable region. (auth)

9436 TWO-PHASE FLUID MODELLING OF THE CRITICAL HEAT FLUX. Hauptmann, E. G.; Lee, V.; McAdam, D. W. (Univ. of British Columbia, Vancouver). pp 557-576 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

Experimental information is presented on dryout using carbon dioxide as the working fluid. The study was conducted to test various scaling laws. The results show that even with an extremely different fluid such as CO_2, the dryout behavior in CO_2 can be adequately related to water and the various freons. (RCK)

9437 TRANSIENT FLOW REDISTRIBUTION IN ANNULAR TWO-PHASE FLOW. Hutchinson, P.; Whalley, P. B.; Hewitt, G. F. (Atomic Energy Research Establishment, Harwell, Eng.). pp 598-616 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

A model for the prediction of transient flow redistribution in isothermal vertical annular flow is presented. The model is based on an analysis of local parameters controlling the flow, and has also been applied to the calculation of flow redistribution in the presence of heat transfer, and therefore, the prediction of burnout. (RCK)

9438 DIFFERENTIAL MODEL OF DRY-OUT IN TWO-PHASE FLOW IN A CIRCULAR TUBE. Rousseau, J. C.; Sursock, J. P. (CEN, Saclay, France). pp 617-636 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In French).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

A differential model is presented for the analytical study of the different elementary phenomena causing dryout. The model is based on the mass balance equation which expresses the variation of the onset of the liquid film as a function of the evaporation and redeposition of droplets. The model derived does not create the existence of the dryout threshold for the gas flow. Nucleation is not considered. The question of whether diffusion itself can explain redeposition is unanswered. The model, however, does furnish in uniform flow results with the same range of precision as results of current empirical correlations, and it permits a better evaluation of the critical conditions in nonuniform flow. (tr-auth)

9439 DIAGNOSTICS OF THE REGIME WITH WORSENING HEAT RELEASE AT SUPERCRITICAL COOLANT PRESSURE. Petukhov, B. S.; Polyakov, A. F. (Inst. for High Temperatures, Moscow). pp 662-680 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In Russian).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

Test data characterizing the conditions for the onset of a regime with worsening heat release during turbulent flow in water and carbon dioxide in pipes at supercritical pressures were analyzed and generalized. An empirical interpolation equation was proposed. It describes the conditions for the onset of the regime with worsening heat release in circular pipes. (tr-auth)

9440 CHARACTERISTICS OF HEAT EXCHANGE IN DISSOCIATING COOLANTS. Kolykhan, L. I.; Mikhalevich, A. A.; Nesterenko, V. B.; Tverkovkin, B. E. (Inst. for Nuclear Power, Minsk). pp 681-703 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In Russian).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

The results of the theoretical and experimental study of the heat exchange in the dissociating coolant N_2O_4 during subcritical and supercritical parameters of state were reported. Heat exchange in the liquid and gaseous phases, heat exchange during boiling, and heat and mass exchange during condensation are considered. (J8R)

9441 COMPARISON CALCULATIONS WITH BLAST-2, A COMPUTER MODEL FOR TWO-PHASE FLOW OF WATER, ON EXPERIMENTS AND OTHER COMPUTER MODELS FOR ONE-DIMENSIONAL FLOW. Grillenberger, T. (Laboratorium fuer Reaktorregelung und Anlagensicherung, Munich). pp 939-961 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In German).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

The computer model BLAST-2 for the calculation of large pressure turbulences in two-phase flow of water was tested on the basis

of several comparisons of calculations to experimental results in which pressure release processes and critical mass flux were studied. The model was also compared with other computer models for one-dimensional flow. (tr-auth)

Materials Testing

Refer also to abstracts 9672, 9673, 9686, 11849, and 11970.

9442 (GEPP-129) ULTRASONIC TEST EQUIPMENT ALIGNMENT. Andrews, R. W. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). 11 Jun 1974. Contract AT(29-2)-656. 9p. Dep. NTIS $4.00.

When conventional techniques of alignment of ultrasonic test equipment did not produce consistently accurate results at the General Electric Neutron Devices Department (GEND), a unique alignment system was devised. Calibration of the inspection equipment is accomplished by the use of disc assemblies with accurately located flat bottomed holes, which are used as standard ultrasonic reflectors. In a hypothetical scan of a circular area, the ultrasonic beam is at all times parallel with the axis of the transducer, perpendicular to the area being scanned, and on a spiral whose origin is coincident with the center of the circular area. However, in actual practice angular errors of yaw and pitch as well as lateral and vertical displacement errors are present. In this new alignment technique, the transducer beam travels on a radial path from one rim to another, passing through the center, scanning the flaw twice. Perfect alignment is obtained when the returns from the two passes are coincident. (auth)

9443 (IRS-A-2) MAXIMUM SIZE OF NONDETECTABLE DEFECTS BY NONDESTRUCTIVE TESTING. Trumpfheller, R. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Nov 1972. Translated by L. R. Franzen from Paper Presented at OECD Experts' Meeting, Brussels, Belgium, May 1972. 9p. INIS.

The effects influencing the determination of defect size in ultrasonic testing of different reactor components are discussed. Furthermore, the acceptance limits in German specifications and those according to ASME Code Section III are given. (GE)

9444 (RDT-F-3-6-T(5-74)) NONDESTRUCTIVE EXAMINATION. (Supplement to ASME Boiler and Pressure Vessel Code, Section V). (USAEC Division of Reactor Research and Development, Washington, D. C.). May 1974. 39p.

This standard supplements the requirements of the 1971 Edition of the ASME Boiler and Pressure Vessel Code, Section V. When this standard is invoked or referenced, the applicable subsections of Section V of the Code are also invoked or referenced. The paragraph numbers in this standard apply only to the 1971 Edition of Section V and its Addenda up to and including the Winter 1973 Addenda. (TFD)

9445 (SLA-74-69) NONDESTRUCTIVE TESTING FOR MECHANICAL DEFECTS IN ATJ-S GRAPHITE. Gieske, J. H.; Butler, B. L.; Guess, T. R.; Freedman, J. M.; Marion, R. H. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1974. Contract AT(29-1)-789. 15p. Dep. NTIS $4.00.

The correlations between the results of both NDT ultrasonic pulse echo and radiation-gaging (DXT) techniques of flaw detection and the degradation of mechanical properties and density of ATJ-S graphite are presented. Control specimens containing few or no detectable flaws were of uniform density and had an average tensile strength of about 5000 psi; the specimens containing detectable flaws had substantial density variations and an average tensile strength of about 3400 psi. The location of ultimate fracture coincided with the location that had given the maximum NDT indication in five of the six flawed specimens. (auth)

9446 AUTORADIOGRAPHY OF MICROSEGREGATIONS IN A RADIOACTIVE MATRIX. Chernikov, V. N.; Zakharov, A. P. Sov. J. At. Energy (Engl. Transl.); 34: No. 4, 355-356(Apr 1973).

Translated from At. Energ. (USSR); 34: No. 4, 287(Apr 1973).

The radiation signal/background ratio in the plane of the surface of a test object above a source of radiation acting in the specimen was calculated as a function of the ratio of the concentration of radioactive isotope in the specimen to the isotope concentration in the surrounding matrix, and also as a function of other parameters determined by the mode of radiation, by the material comprising the test object, and by the geometry of the source. The results of the studies permitted quantitative information on the details of the inner structure of the test object and also information on certain limitations of the autoradiographic method to be obtained. (RCK)

9447 INTERRELATIONSHIPS BETWEEN MECHANICAL PROPERTIES AND THE SIGNIFICANCE OF DEFECTS. Nichols, R. W. (United Kingdom Atomic Energy Authority, Warrington, Eng.). pp 3-10 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From second international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

Some of the recent developments in the use of fracture mechanics to define the acceptable sizes and shapes of flaws in single-wall steel pressure vessels are reviewed. The results of such appraisals are being incorporated in standard specifications and codes, for example in ASME and UK proposals. These steps make towards a worthwhile improvement in assessed reliability, and put in perspective particularly the considerable tolerance for porosity and slag inclusion flaws. Even so, for crack-like defects there are uncertainties still left after making such an analysis: these can be reduced by devoting sufficient attention to quality control of material fracture toughness, fabrication routes and inspection methods. The choice of materials of high intrinsic fracture toughness and low sensitivity to fabrication and process is of great importance. From the nondestructive examination side, reliability and certainty of reporting are more important than sensitivity, putting the emphasis on automated recording techniques and on overall inspection tools such as acoustic emission. Attention to these aspects must be given when considering permissible design stresses and permissible stress concentration levels. (auth)

9448 RADIOGRAPHIC INSPECTION OF PRESSURE VESSELS. Tomita, T. (Mitsubishi Heavy Industries, Ltd., Tokyo). Boira Kenkyu; No. 139, 14-23(Jun 1973). (In Japanese).

Five types of nondestructive testing methods are summarized, and compared. Principles applicable ranges and detectable defects are discussed for radiographic, ultrasonic, magnetic flux, magnetic particle, and penetrant inspections, of which the radiographic inspection has become the standard method. A classification of the radiographic inspection required for various situations is presented. The classification proposed by I.I.W. is shown. The first class of pressure vessels principally corresponds to the first class by I.I.W. Some discussion is presented regarding the method and applicable range of radiographic inspection of welded joints. The detection and evaluation of defects in welded parts based on the radiographic inspection are considered. Some complementary materials available for the detection method are given. For example, the porosity charts of ASME and JIS are represented. The relation between various types of defects and strength is also given. Finally, specific criteria for the detection of defects in pressure vessels by the radiographic inspection are given. (JA)

9449 HIGH ENERGY FLASH X-RAY FACILITY. Gilbert, J. F.; Carrick, D. P. A. (Atomic Weapons Research Establishment, Foulness, Eng.). Brit. J. Non-Destruct. Test.; 16: No. 3, 65-71(May 1974).

From NDT conference; Bath, England (Sep 1973).

Flash radiography equipment designed primarily for the radiography of explosive assemblies is described. It is the most powerful flash x-ray system in the UK at the present time and can produce radiographs through a steel thickness (equivalent) of 4.5 in. The radiographic factors involved are discussed. Further development, notably in the reduction of the focal spot size, is envisaged. The present equipment operates up to 3 MeV and has an output of 40 to 50 R per flash, measured at 1 meter distance. The pulse length is 60 ns. (auth)

9450 PROBLEMS OF NONDESTRUCTIVE TESTING (NDT). Pfender, M. (Bundesanstalt fuer Materialpruefung, Berlin). Z. Werkstofftech.; 5: No. 3, 109-118(Apr 1974). (In German).

The real problems of nondestructive inspection of materials and components are, besides reliable further development of inspection methods, the combination of test results with the result of stress analysis related to properties and stress of the inspected material. A systematic survey of the possibilities of destructive and nondestructive materials testing may be helpful to find a solution of these problems. (GE)

Nuclear Explosions

Refer also to abstracts 9533 and 9650.

9451 (AD-771111) EXTENDED ARRAY EVALUATION PROGRAM. Special Report No. 8. Final Evaluation of the Detection and Discrimination Capability of the Alaskan Long Period Array. Report for April 1, 1972–March 31, 1973. Strauss, A. C. (Texas Instruments, Inc., Dallas (USA)). 29 Jun 1973. Contract F33657-72-C-0725. 116p. NTIS $8.00.

The continued evaluation of the 19-element Alaskan Long Period Array (ALPA), which was conducted at the Seismic Data Analysis

Center over the period 1 April 1972 to 31 March 1973 is described. The major areas of study in the evaluation were: noise analysis; regionalization of seismic events; matched filter performance; analysis of S-wave processing for the Kurile Islands–Kamchatka region; seismic event detection thresholds; and behavior of seismic discriminants. (GRA)

9452 (AD-771112) EVALUATION OF THE DETECTION AND DISCRIMINATION CAPABILITIES OF THE VERY LONG PERIOD EXPERIMENT (VLPE) SINGLE STATIONS, VLPE NETWORK, AND THE VLPE–ALPA–NORSAR COMBINED NETWORK. Special Report No. 6, April 1, 1972–December 31, 1973. Lambert, D. G.; Becker, E. S. (Texas Instruments, Inc., Dallas (USA)). 18 May 1973. Contract F33657-72-C-0725. 173p. NTIS $10.75.

An evaluation is presented of the detection and discrimination capabilities of nine VLPE stations, the VLPE network, and the VLPE-NORSAR-ALPA combined network. The data base consists of 545 Eurasian seismic events occurring during the periods January 1 through March 20 and June 1 through July 31, 1972. (auth)

9453 (AD-771276) FIREBALL ENTRAINMENT STUDY. Semiannual Report, August 1, 1972–April 30, 1973. Haigh, W. W.; Mantrom, D. D. (TRW Systems Group, Redondo Beach, Calif. (USA)). Nov 1973. Contract DNA001-72-C-0019. 45p. (DNA-3139-Z). NTIS $4.25.

A continuation of an experimental program to study the process of entrainment and turbulent mixing in fireballs is described. Recent modifications and additions to the experimental facility are discussed. Both laminar and turbulent helium concentration data are presented, reduced by an ensemble averaging technique based on physical features of the flow field. Laboratory turbulent size/rise data are presented and are shown to be in excellent agreement with data from a low altitude, low yield nuclear test. Photographs of particulate seeded vortices show a distinct jelly-role structure at a laminar condition whereas turbulent mixing in higher Reynolds number events is shown to overwhelm that structure. (auth)

9454 (AD-771584) NUCLEAR DEBRIS ATTACHMENT TO AIRCRAFT DUE TO ATMOSPHERIC RADIATION ENVIRONMENTS. Part I. General Studies. Final Report, December 1970–October 1972. Perley, W. B.; Pfeifer, R. J. (Industrial Nucleonics Corp., Columbus, Ohio (USA)). Oct 1972. Contract F33615-71-C-1102. 160p. (AFFDL-TR-72-117(Pt. 1)). NTIS $10.00.

An extensive empirical and analytical investigation of the contamination accumulated by aircraft flying through nuclear debris clouds indicates that, for most operational circumstances, the contamination does not interfere with on-board nucleonic instrumentation. The empirical approach has consisted of measurement and processing phases. Basic radiation intensity measurements were made on ten aircraft which had penetrated debris clouds produced by French nuclear test detonations in 1970 and 1971. In general, a repeatable correlation between contamination levels and aircraft locations was observed. The analytical approach has consisted of the formulation of a particle attachment model and the integration of this attachment model and an aircraft fly-through model with an existing water-surface-burst debris cloud model to predict gross contamination intensity. (auth)

9455 (AD-771585) NUCLEAR DEBRIS ATTACHMENT TO AIRCRAFT DUE TO ATMOSPHERIC RADIATION ENVIRONMENTS. Part II. Aircraft Impaction and Adhesion Computer Model. Final Report, December 1970–October 1972. Perley, W. B.; Pfeifer, R. J. (Industrial Nucleonics Corp., Columbus, Ohio (USA)). Oct 1972. Contract F33615-71-C-1102. 140p. (AFFDL-TR-71-117 (Pt.2)). NTIS $9.00.

The report describes in detail the CLOUDRISE and SLURRY/PASS programs for users of the codes. These codes were developed to aid analytic studies of the contamination acquired by an aircraft which flies through a nuclear debris cloud, as explained in Part I, General Studies. (auth)

9456 (AD-771920) MATERIAL PROPERTY INVESTIGATION FOR PROJECT MIDDLE GUST, EVENTS IV AND V. Report 1. Subsurface Exploration and Laboratory Test Results. Knott, R. A.; Vispi, M. A.; Farrell, W. J. (Army Engineer Waterways Experiment Station, Vicksburg, Miss. (USA)). Oct 1973. 542p. (AEWES-TR-S-73-11-1). NTIS $10.00.

The results of a site investigation conducted to support a program of free-field ground shock calculations and field operations for Project MIDDLE GUST, Events 4 and 5 are presented. The site is characterized by a 28-ft-thick section of weathered clay shale overlying approximately 650 ft of competent clay shale of the Pierre Formation which overlies older sedimentary rocks. Complete boring logs, material classifications, and radiographic logs are presented that describe the subsurface materials at the site. The physiography, geologic history, stratigraphy, structure, and lithology of the subsurface materials are also described. In addition to the usual material classification, index, and composition tests, an extensive series of static and dynamic, unconsolidated-undrained, uniaxial strain and triaxial compression tests were conducted on specimens obtained from undisturbed samples taken at the site. (auth)

9457 (ARH-2351) SHEAR-LEACH PROCESSING OF N-REACTOR FUEL–CLADDING FIRES. Schulz, W. W. (Atlantic Richfield Hanford Co., Richland, Wash. (USA). Separations Chemistry Lab.). 15 Feb 1972. Contract AT(45-1)-2130. 39p. Dep. NTIS $5.00.

Cladding fires which occurred in 1967 and 1968 during shear-leach processing of irradiated N-Reactor fuel (Zircaloy-clad uranium) at the Nuclear Fuel Services, Inc., West Valley, New York, facility are described. Limited laboratory investigations suggest that these fires either occurred, or at least were triggered, when HNO_3-sensitized weld beads on the ends of fuel rods ignited (by mechanical shock) and burned. Beryllium in the weld Zr–Be system is preferentially attacked in HNO_3 solutions. A sensitized zirconium metal matrix results which, when shocked electrically or mechanically, detonates in air with a loud report and a brilliant white flash. Insufficient data were obtained to establish if detonation of sensitized weld beads would ignite sheared Zircaloy cladding fires, U–Zr alloy in the diffusion zone between cladding and core, or hydrided cladding. (auth)

9458 (EERL-MP-E-74-2) INVESTIGATION OF INTERMEDIATE- AND MAXIMUM-RANGE MISSILES PRODUCED BY CRATERING EXPERIMENTS. Dishon, J. F. III. (Army Engineer Waterways Experiment Station, Livermore, Calif. (USA). Explosive Excavation Research Lab.). Mar 1974. 105p. Dep. NTIS $5.45.

A method is developed for the prediction of the probability of missile impact upon a given structure or object and the maximum missile range from a cratering event. The data are from missile areal distribution studies made after several high explosive cratering events. Several empirical and theoretical scaling techniques are used to combine the missile areal distribution data into a form that allows the prediction of missile impact probability and maximum missile range as a function of charge yield, media, and depth of burial. This method of prediction is of direct interest in determining missile damage from typical explosive cratering events. (auth)

9459 (ORNL-4960) TRANSIENT RESPONSE OF LOW FREQUENCY VERTICAL ANTENNAS TO HIGH ALTITUDE NUCLEAR ELECTROMAGNETIC PULSE (EMP). Barnes, P. R.; Nelson, D. B. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. 43p. Dep. NTIS $4.00.

Several antenna models are used to calculate the transient response of top-loaded LF vertical antennas to EMP from high altitude nuclear detonations. Examples are given of the short circuit current and voltage across an idealized load for a 360 meter high, top-loaded antenna illuminated by two representative EMP fields. Good agreement is obtained among all the models used. The effect of the angle of incidence θ is quite pronounced. The early time current and voltage at 30° is almost twice what it is at 90°, confirming the $\sin^{-1}\theta$ behavior. On the other hand, end effects occur sooner at 30°, reducing the low frequency content. Thus the late time behavior is largest at 90°. In general it will be true for long antennas that effects depending on initial rate of rise will be maximized for small θ, whereas effects that depend on total surge energy are maximized for broadside incidence. (auth)

9460 (LA-5572-MS) DESIGN AND DEVELOPMENT OF A COMBINATION IMPULSE TRANSDUCER. Starkovich, V. S.; Stephani, E. L.; Hawkins, E. V. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1974. Contract W-7405-eng-36. 9p. Dep. NTIS $4.00.

An impulse transducer gauge capable of providing both active and passive measurements of x-ray-produced blowoff impulse is described. The gauge is a combination of the compatible features of the Philco-Ford passive wirecutter gauge and the LASL Probe Velocity Transducer. The transducer has been used with success on three underground nuclear tests. (auth)

9461 (PEM-35) NUCLEAR EMP: EMP HARDENING APPROACH FOR SAM-D. Warner, G. L.; Doskocil, A. C. (Raytheon Co., Bedford, Mass. (USA). Missile Systems Div.). 1973. 26p. (CONF-730935-6). Dep. NTIS $4.50.

From EMP technical meeting; Kirtland AFB, New Mexico, USA (25 Sep 1973).

The SAM-D mobile antiaircraft missile system is required to be hardened against the nuclear EMP environment. As the system design evolved, it was found that the single point ground concept originally specified for EMP survivability conflicted with the practical aspects of obtaining a grounding, shielding and filtering

design which would meet electromagnetic compatibility specifications. Out of this conflict originated the concept of zonal mass grounding, which permits mass grounding within shielded zones, yet effectively isolates the common ground between communicating zones for frequencies within the EMP spectrum. The grounding system described provides the combination of a zonally isolated ground system for EMP protection and a mass grounding system for high frequency circuit operation. The SAM-D weapon system, a listing of the applicable MIL-STD's with brief requirements, and general design guides which were used to achieve zonal mass grounding in the SAM-D system are described. (auth)

9462 (SLA-74-200) CERTAIN IMPORTANT ASPECTS ASSOCIATED WITH THE He CONTAINMENT PROBLEM. Webb, D. M.; Chen, P. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Apr 1974. Contract AT(29-1)-789. 12p. Dep. NTIS $4.00.

Recently, there have been considerable activities in the area of He containment. It is obvious that studies with full-scale tests of real weapon systems are not practical, therefore, the testing of models is necessary. These models are placed in specially designed containment systems which hopefully can withstand the forces due to the detonation of the He and not allow any fragment to scatter. The containment systems usually consist of concentric cylindrical shells with various kinds of filler materials placed between. Certain important factors which must be accounted for in the design of the models and which have definite influences in the design of the containment systems are reported. (auth)

9463 (TID-3522-R9-S2) SELECTED, ANNOTATED BIBLIOGRAPHY OF THE CIVIL, INDUSTRIAL, AND SCIENTIFIC USES FOR NUCLEAR EXPLOSIONS. Kelly, R. C. (comp.). (USAEC Technical Information Center, Oak Ridge, Tenn.). Apr 1974. 125p. Dep. NTIS $5.45.

This supplement to bibliography TID-3522 (9th Rev.) contains 478 references to reports and published literature on the USAEC's Plowshare Program that were published in Volumes 26 and 27 (January 1, 1972 to June 30, 1973) of Nuclear Science Abstracts. The references are arranged by subject category. Experiment, Foreign Literature, Corporate Author, Personal Author, Subject, and Report Number Indexes are included. (auth)

9464 (UCID-15653) FIELD MEASUREMENTS OF FRACTURE PERMEABILITY IN GRANODIORITE. McMullen, E. T.; Pasternak, A. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 May 1970. 25p. Dep. NTIS $4.25.

Field measurements of fractured granodiorite were made August 6–7, 1969, in hole "B" of the main drift of the tunnel used to emplace the Piledriver device. Measurements were made by isolating 5 foot sections of the 3" diameter hole with "straddle packers" and flowing air into the isolated region. A schematic of the equipment is shown. The experiment was abruptly terminated when the prototype straddle-packer shaft became inextricably lodged in the hole, probably due to a cave-in. Measurements were made for the first 50 feet of the hole and are summarized. The data were obtained by a flow method and a pressure decay method. Both these methods seem to agree and give valid results, however the premature termination of the experiment prevented enough data to be taken to provide positive proof. (auth)

9465 (UCID-15915) BEARPAW SHALE: MATERIAL PROPERTIES DERIVED FROM EXPERIMENT AND ONE-DIMENSIONAL STUDIES. Crowley, B. K.; Burton, D. E.; Bryan, J. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Sep 1971. 83p. Dep. NTIS $7.25.

Work currently underway to develop calculational techniques for predicting the effects of low-yield (20 ton) high-explosive charges emplaced at optimum cratering depth with conventional, water, and air stemming of the emplacement hole is described. Ultimately, the results of this study will be used to design high-explosive configurations which will simulate nuclear explosives. This calculational work is intended to complement the Diamond Ore high explosive experiments which will be conducted in Bearpaw shale at Fort Peck, Montana. Some laboratory and field data obtained for Bearpaw shale during Pre-Gondola I are summarized. One dimensional simulations using the SOC code are described. The sensitivity of the calculations to variations in the material constants used in the code is discussed. This work has resulted in a description of Bearpaw shale to be used in two-dimensional TENSOR calculations. (auth)

9466 (UCID-15968) PROJECT RIO BLANCO: PHASE I, TECHNICAL STUDIES. Toman, J.; Tewes, H. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Jan 1972. Contract W-7405-eng-48. 140p. Dep. NTIS $10.00.

Project Rio Blanco is the third experiment in the application of contained underground nuclear explosions to stimulate natural gas production. To support the formulation of a project definition document for this experiment, Lawrence Livermore Laboratory has conducted technical studies in several pertinent areas. Among these are the elucidation of rock properties at the detonation site, a prediction of explosion effects, a treatment of expected gas production from the stimulated well, and a study of radioactivity production and gas quality. Proposals are made for meaningful technical measurements and possible add-on programs. (auth)

9467 (UCID-15999) TECHNIQUE OF OBTAINING GAS SAMPLES FROM UNDERGROUND NUCLEAR DETONATIONS. Grens, J.; Morris, G.; Skinner, D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Mar 1972. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

A steel cable assembled within a pressure hose is used to obtain samples of gas from an underground nuclear detonation for diagnostic and chemical studies. The system for securing and handling the samples and the normal operating procedures are described. (auth)

9468 (UCID-16154) CHIMNEY PERMEABILITY BY ATMOSPHERIC PRESSURE CHANGE: INSTRUMENTS AND DATA HANDLING. Snoeberger, D. F.; Morris, C. J.; Baker, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Nov 1972. Contract W-7405-eng-48. 14p. Dep. NTIS $4.00.

The Chimney Breather experiment is reported. The purpose of the experiment was to determine the permeability of a nuclear chimney in alluvium at the AEC Nevada Test Site. The instrumentation and data handling systems are described. Microbarometric instruments were used to sense atmospheric and underground pressures. Data were taken for a period of two months in early 1972. These data were transmitted by telephone and stored, for later calculation and plotting. Data taking was interrupted for three six-hour periods and for 12 other periods of shorter duration. (auth)

9469 SECONDARY SOURCES OF SEISMIC WAVES FROM UNDERGROUND NUCLEAR EXPLOSIONS. Springer, D. L. (Univ. of California, Livermore). Bull. Seismol. Soc. Amer.; 64: No. 3, 581-594(Jun 1974).

Surface-reflected seismic energy from underground explosions, in the form of a pP phase and a spall-closure (slapdown) phase, P_s, may contribute to the P wave and coda seen at teleseismic distances. Delay times corresponding to pP–P and P_s–P are estimated from surface-zero accelerograms for a number of U. S. underground nuclear explosions and are presented for use by the seismological community. When compared with published estimates, these pP–P estimates are in reasonable agreement but the P_s–P estimates are at wide variance. No ready explanation is at hand for the disagreement. (auth)

9470 DEFINITION AND IDENTIFICATION OF SEISMIC EVENTS IN THE USSR IN 1971. Dahlman, O.; Israelson, H.; Austegard, A.; Hoernstroem, G. (Hagfors Observatory, Stockholm). Bull. Seismol. Soc. Amer.; 64: No. 3, 607-636(Jun 1974).

Seismic events reported to have occurred in the USSR in 1971 are studied to assess the seismic monitoring problem as it may occur in the context of a complete test-ban treaty. Available epicenter data of a total of 199 events, 180 earthquakes and 19 explosions, are presented. Focal depth estimates reported by the National Oceanic and Atmospheric Administration, U. S., and the Institute of Physics of the Earth, Moscow, are compared. Identification parameters determined using short- and long-period data from Hagfors Observatory and supplementary short-period data from the Yellowknife array station in Canada are presented. To study the combined operative efficiency and applicability of available identification parameters, the reported depth estimates and the identification data are assessed in a defined way. (auth)

9471 ANALYSIS OF THE OPERATIONAL CAPABILITIES FOR DETECTION AND LOCATION OF SEISMIC EVENTS AT NORSAR. Bungum, H.; Husebye, E. S. (NTNF/NORSAR, Kjeller, Norway). Bull. Seismol. Soc. Amer.; 64: No. 3, 637-656(Jun 1974).

Based on 1 year of data, April 1972–March 1973, the routine event detectability of the NORSAR array in Norway has been investigated in terms of 50 and 90% cumulative detectability thresholds which were derived from frequency-magnitude distributions. The best performance was observed for events in central Asia and adjacent regions where the 90% cumulative detectability values are in the range from 3.6 to 3.8 NORSAR m_b values. For teleseismic events, the value is 3.8. For all regions, NOAA reports on the average a larger m_b value than NORSAR, and this relationship is magnitude-dependent. The accuracy of NORSAR-estimated epicenter solutions as compared to those of NOAA was also investigated. The best results were found for Japan and central Asia, where the median location difference is 95 and 105 km, respectively. For teleseismic events, the value is 145 km. The biased errors in the location estimates are demonstrated to have been

eliminated for most of the regions considered. Finally, improvements of the present NORSAR event detectability performance are discussed in view of recently developed array data processing techniques. (auth)

9472 ARRANGEMENT FOR SIMULATING ELECTRICALLY RADIATION AND LIGHT FROM NUCLEAR EXPLOSIONS. Fruengel, F. US Patent 3,808,704. 7 May 1974. Priority date 24 Nov 1970, F.R. Germany. 6p.

A portable arrangement for simulating the electromagnetic pulse and light of a nuclear explosion is described. An antenna circuit has an inductance and a charging capacitor. A spark gap is connected in parallel with the capacitor. To simulate the electromagnetic pulse, the capacitor is charged from a high voltage until breakdown occurs across the spark gap, thereby causing the EMP to be radiated from the antenna. An electronic timing circuit is connected to the capacitor and furnishes a signal igniting a flash a predetermined time interval after creation of the EMP. A second timing circuit initiates a second flash a predetermined time interval following the first flash. The EMP and first flash test the nuclear detection sensor, while the second tests the operation of a protective shutter associated with the sensor. (Official Gazette)

9473 METHOD FOR ESTIMATION OF THE ELAPSED TIME AFTER A NUCLEAR EXPLOSION BY MEASURING THE ACTIVITY OF ^{95}Nb IN THE RADIOACTIVE FALLOUT. Tatewaki, T. (Shinshu Univ., Nagano, Japan). Shinshu Daigaku Kogakubu Kiyo; No. 33, 27-36 (Dec 1972). (In Japanese).

A new method for estimation of the elapsed time after a nuclear explosion from radioactive fallout was developed wherein the activity of ^{95}Nb is measured by a high-resolution Ge(Li) gamma-ray detector. The elapsed time after the nuclear explosion was calculated by this method from the two measured values of the activity of ^{95}Nb at given time intervals in the highly radioactive fallout particles due to the seventh Chinese nuclear test explosion on 24 December 1967. The results were in fairly good agreement with the true values of the elapsed time, and also with the estimated values of the elapsed time obtained from the activity ratio of of ^{95}Zr to ^{95}Nb. The expected errors for the results, the measurement accuracies for the number of the atoms of ^{95}Nb, and the time intervals necessary to estimate the elapsed time within the errors 1 to 2 days are given in the tables. (auth)

Protective Structures and Equipment

9474 (LA-5574-PR) RESPIRATOR STUDIES FOR THE AEC DIVISION OF OPERATIONAL SAFETY. Progress Report, July 1–December 31, 1973. Held, B. J.; Lowry, P.; Bevis, D. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1974. Contract W-7405-eng-36. 9p. Dep. NTIS $4.00.

Work performed by the LASL Respirator Research and Development Section, Industrial Hygiene Group, for the AEC Division of Operational Safety (DOS) during the first half of FY 1974 is reported. Major projects included providing respirator training for AEC contractors and AEC Operations Office personnel, testing various respiratory protective devices, evaluating the relationship between anthropometric characteristics of the working population and respirator performance, revising a draft of DOS Respirator Guide No. 1, and providing consulting services for the DOS and contractors. (auth)

Safety Engineering

9475 (K-GD-1009) OPEN INTERLOCK DETECTOR. Seaborn, G. B. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). May 1974. Contract W-7405-eng-26. 7p. Dep. NTIS $4.00.

An electronic device is described which detects and indicates the opening of an interlock. An interlock is a switch arranged to shut down electrically-operated equipment for the protection of the equipment or personnel. For example, a cabinet containing high voltage hazardous to life will be provided with a door interlock arranged so that the opening of the door will operate the interlock and shut off the high voltage. Since electrically-operated equipment may contain several interlocks, it is often desirable, in case of equipment shutdown, to know which interlock was responsible. The open interlock detector provides that information. (auth)

9476 FIRE IN THE KARLSRUHE NUCLEAR RESEARCH CENTRE. At. Inform.; No. 1, 13 (1974). (In German).

In the course of construction in the decontamination department of the Centre, a fire broke out in one room, which was probably caused by self-ignition of polyurethane foams. The fire did not get far and was soon brought under control. No damage was caused to any person, nor was there any increase in the level of radioactivity in the vicinity of the fire. Investigations for appraisal of the damage are still under way. (GE)

Vacuum Engineering

9477 A CONVENIENT ELECTRICAL DISCHARGE METHOD FOR ELIMINATING HYDROCARBON CONTAMINATION FROM STAINLESS STEEL UHV SYSTEMS. Lambert, R.M.; Comrie, C.M. (Department of Physical Chemistry, University of Cambridge, Cambridge, CB2 1EP. England). J. Vac. Sci. Technol. 11: No. 2, 530-531 (Mar 1974).

It was necessary to remove the last traces of hydrocarbon vapor from a stainless steel UHV system which had been fitted with a contaminated component. The method that proved to be successful, and which quickly removed all detectable traces of undesirable residues, was to subject the entire apparatus to a low-pressure dc discharge in oxygen. A stainless steel anode was placed in the center of the chamber, and all other components were grounded. Discharge conditions were 100 mA at 500 V in the presence of $\sim 10^{-2}$ Torr of flowing spectroscopic grade oxygen. The discharge was run for 10 hours. The method produced no apparent undesirable side effects. The most likely mechanism for this cleanup is discussed briefly. (RWR)

ENVIRONMENTAL AND EARTH SCIENCES

Minerals and Ores

Refer also to abstract 9538.

9478 (EIR-252) THORIUM, URANIUM, OTHER METALS, AND MATERIALS FROM EARTH'S CRUST ROCKS. Taube, M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Apr 1974. 33p. Dep. NTIS (US Sales Only) $4.75.

The general use of the rocks of the earth's crust as a source of nuclear energy (from thorium-uranium extracted with 30% efficiency), and a source of metals (aluminium, iron, etc.), a source of ceramics (cement, glass, quartz) and other materials is discussed. The proposal is to use their source to meet the needs of a future stable civilization requiring a unit power production of some 20 kW per capita and source material supply of 1 ton per capita per year (additional to recycling). The impact of this on the philosophy of reactor development is also discussed. (auth)

9479 (GJO-100(74)) STATISTICAL DATA OF THE URANIUM INDUSTRY. (USAEC Grand Junction Office, Colo.). 1 Jan 1974. 69p. Dep. NTIS $1.30.

Statistical data are presented on the following aspects of the U. S. uranium industry: ore and concentrate purchases; ore production and reserves; distribution of deposits; drilling statistics; exploration expenditures; land holdings for uranium mining and exploration; employment; commercial U_3O_8 sales and requirements; and processing mills. (LCL)

9480 (GJO-7404) U, K, AND Th CONCENTRATIONS IN DEVONIAN SEDIMENTARY ROCKS OF THE CATSKILL MOUNTAIN AREA AND THEIR INTERPRETATION. Way, J. H. Jr.; Friedman, G. M. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA)). 14 May 1971. Contract AT(30-1)-3982. 73p. Dep. NTIS $6.75.

The rocks of the Catskill Mountain area were investigated as possible host rocks for uranium. Analytical data, U, K, and Th concentrations, derived from samples collected under careful stratigraphic and environmental control were analyzed by statistical methods. Stepwise discriminant function analysis showed that there was not enough variability in the data nor enough change from one measured section to another to effect a separation of sections at any statistically significant level. Using linear regression and correlation analysis, potassium and thorium show a dependency on each other to a greater degree than either potassium versus uranium or thorium versus uranium. No definite conclusions were reached in attempting to explain why uranium concentrations throughout the area were so low. (auth)

9481 (GJO-7406) RADIOACTIVE TRACE ELEMENTS IN MIDDLE AND UPPER DEVONIAN CLASTIC ROCKS, CATSKILL MOUNTAIN AREA, NEW YORK. Way, J. H. Jr.; Friedman, G. M. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Dept. of Geology). 1972. Contract AT(30-1)-3982. 25p. Dep. NTIS $4.25.

Uranium concentrates in spotty lenses of interbedded braided and alluvial stream deposits of Upper Devonian age. Occurrences are of low uranium content (<400 ppM), but above the background of 1 to 5 ppM. The concentrations occur in roadcuts along Route 17 in gray and green channel sandstones and in some gray-colored zones beneath sandstones at the top of red mudstone lenses. Where the uranium concentrates plant debris, pyrite nodules and malachite tend to be common. While these uranium concentrations are uneconomic they are of interest because of their similarity to Upper Devonian occurrences of uranium in northeastern Pennsylvania. Similar spotty uranium concentrations may occur in Upper Devonian rocks throughout the Catskill Mountains. (auth)

9482 (GJO-7407) RADIOACTIVE TRACE ELEMENTS IN UPPER DEVONIAN CLASTIC ROCKS, NORTH-CENTRAL PENNSYLVANIA. Humphreys, M.; Friedman, G. M. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Dept. of Geology). 1972. Contract AT(30-1)-3982. 15p. Dep. NTIS $4.00.

Local concentrations of uranium occur in north-central Pennsylvania. The dominant lithofacies encountered in this region may be interpreted as representing meandering stream channels and associated overbank deposits. The uranium concentrates at the base of gray, crossbedded channel or sheet sands. Coalified wood fragments and local concentrations of malachite occur in close association with the uranium deposits. Sampling on a regional basis confirms McCauley's observation that the uranium deposits occur at preferred stratigraphic levels, whereas the rock above and below these levels is relatively barren of uranium. It is concluded that there is no significant economic potential to the uranium concentrations in north-central Pennsylvania, as now known. (auth)

9483 METEORIC WATER IN MAGMAS. Friedman, I. (Geological Survey, Denver); Lipman, P. W.; Obradovich, J. D.; Gleason, J. D.; Christiansen, R. L. Science; 184: No. 4141, 1069-1072 (7 Jun 1974).

Oxygen isotope analyses of sanidine phenocrysts from rhyolitic sequences in Nevada, Colorado, and the Yellowstone Plateau volcanic field show that $\delta^{18}O$ decreased in these magmas as a function of time. This decrease in $\delta^{18}O$ may have been caused by isotopic exchange between the magma and groundwater low in ^{18}O. For the Yellowstone Plateau rhyolites, 7000 cubic kilometers of magma could decrease in $\delta^{18}O$ by 2 per mil in 600,000 years by reacting with water equivalent to 3 millimeters of precipitation per year, which is only 0.3 percent of the present annual precipitation in this region. The possibility of reaction between large magmatic bodies and meteoric water at liquidus temperatures has major implications in the possible differentiation history of the magma and in the generation of ore deposits. (auth)

9484 EXPLORATION GUIDES TO NEW URANIUM DISTRICTS AND BELTS. Fischer, R. P. (Geological Survey, Denver). Econ. Geol.; 69: No. 3, 362-376(May 1974).

The principal U. S. source of uranium is deposits in continental, lenticular sandstone beds. Beds of this type are probably the best hunting ground for groups of significant new deposits—in reality, new districts and belts—that will be needed to satisfy future requirements for uranium. A model, evolved from the major productive districts and belts, presents geologic relations that may be useful as guides in selecting the beds and areas most likely to contain significant deposits. Host rocks favorable for large uranium deposits are sandstone lenses interbedded with mudstone; these mudstone beds or some overlying beds commonly contain volcanic ash. Sedimentation on a low-lying terrane with a high water table, yielding nonoxidizing conditions of water-saturated beds, is indicated by the preservation of coalified fossil plants, which are present in almost all host beds. During ore formation the host beds dipped gently, owing to initial stream gradient or slight tectonic tilting. The ore-forming solutions were ground waters that moved downward by gravity. The ore formed slowly under stable conditions, at shallow to moderate depths, in zones a few miles to a few tens of miles from the depositional or erosional edges of the host beds, at places where adequate reducing conditions were encountered. The reducing agents are obscure and perhaps varied. Roll-type deposits seem to have formed relatively late after accumulation of the host beds, whereas tabular-type deposits may have formed relatively soon after sedimentation. Sandstone units having some or all of the lithologic characteristics favorable for uranium deposits are numerous and widespread in the United States and they occur in areas of different geologic setting and history. If new districts are to be found at tolerable costs, geologic guides will have to be used to select for exploration the sandstone units and areas most likely to contain groups of significant deposits. A few areas, and one hypothetical case, are selected to illustrate the application of the geologic relations of the model as a guide in the preliminary evaluation of possible exploration targets. Intensive library and field studies should disclose other possible target beds and areas. (auth)

9485 URANIUM RESOURCES AND SUPPLY. Cameron, J. Int. At. Energy Agency Bull.; 16: No. 1/2, 90-93(1974).

Estimates of worldwide resources of uranium are tabulated and discussed. (LCL)

9486 PROCEEDINGS OF THE SECOND SEMINAR ON GEOCHEMICAL PROSPECTING METHODS AND TECHNIQUES HELD AT PERADENIYA, CEYLON, SEPTEMBER 10-20, 1970. Mineral Resources Development Series, No. 38. New York; United Nations (1970). 435p. (CONF-700988-). $9.00.

Topics covered include: geochemical prospecting techniques; status of geochemical exploration in Asian countries, Australia, and New Zealand; regional reconnaissance geochemical exploration; detailed geochemical exploration; uses of mineralogy and petrology in geochemical exploration; integrated geochemical and geophysical exploration; interrelations of aerial photography with geobotanical and biogeochemical exploration; recent advances in analytical techniques; statistical procedures in geochemical exploration; use of non-professional assistants in mineral exploration; and geology, geomorphology, and soils of Ceylon. Separate abstracts were prepared for seven papers. (MCG)

For abstracts of individual papers see: 9487-9493.

9487 GEOCHEMICAL PROSPECTING IN TAIWAN, CHINA. Tan, L. P. (National Taiwan Univ., Taipei). pp 32-34 of Proceedings of the Second Seminar on Geochemical Prospecting Methods and Techniques. New York; United Nations (1970).

From 2nd seminar on geochemical prospecting methods and techniques; Peradeniya, Ceylon (10 Sep 1970). See CONF-700988-.

Soil geochemical prospecting was first carried out in Taiwan in 1957. At present, geochemical prospecting in Taiwan is concentrated on copper, gold, monazite and zircon, mercury, and nickel, and is used to explore for geothermal energy. Current geochemical prospecting activities are discussed. (LCL)

9488 PRESENT STATUS OF GEOCHEMICAL PROSPECTING FOR METALLIC ORE DEPOSITS IN JAPAN. Tono, N. (Geological Survey of Japan, Kawasaki). pp 48-50 of Proceedings of the Second Seminar on Geochemical Prospecting Methods and Techniques. New York; United Nations (1970).

From 2nd seminar on geochemical prospecting methods and techniques; Peradeniya, Ceylon (10 Sep 1970). See CONF-700988-.

Methods of geochemical prospecting for metallic ores in Japan as of 1970 are outlined. The main metals considered include copper, lead, zinc, gold, silver, mercury, manganese, and uranium. Research on using measurements of the $^{32}S/^{34}S$ ratio of geologic deposits in iron ore prospecting is mentioned. (LCL)

9489 EXPLORATION GEOCHEMISTRY IN NEW ZEALAND. Brooks, R. R. (Massey Univ., Palmerston North, N. Z.). pp 73-87 of Proceedings of the Second Seminar on Geochemical Prospecting Methods and Techniques. New York; United Nations (1970).

From 2nd seminar on geochemical prospecting methods and techniques; Peradeniya, Ceylon (10 Sep 1970). See CONF-700988-.

Geochemical and biogeochemical exploration work carried out in New Zealand by private companies, government departments, and universities is described. The methods used by these agencies in exploring for mineral deposits, including uranium, and geothermal areas are reported. (LCL)

9490 RARE EARTHS OF MONAZITES AND GEOLOGY OF SOUTHERN MADAGASCAR. Altmann, J. (Bureau des Recherches Geologiques et Minieres, Paris); Radelli, L.; Serre-Ratsimandisa, R. pp 115-126 of Proceedings of the Second Seminar on Geochemical Prospecting Methods and Techniques. New York; United Nations (1970).

From 2nd seminar on geochemical prospecting methods and techniques; Peradeniya, Ceylon (10 Sep 1970). See CONF-700988-.

The distribution of the yttrium-earths in 274 monazites of several tectonic units of the basement of southern Madagascar was determined through spectral analysis, and it is studied in connection with the tectono-sedimentary character of those units. The hypothesis that the rare earths reach the sedimentary basins in an ionic state is presented in order to explain the data obtained, including the results of a regional geochemical survey for yttrium and lanthanum, which survey showed an opposite distribution of these elements. The relationship between the pH of a depositional environment and that of the rare earths precipitated in it is indicated. A chemical origin of the monazites of the para-metamorphic rocks is suggested in place of a pure detrital one. (auth)

9491 INFLUENCE OF GRAIN SIZE ON PERCENTAGES OF ThO_2 AND U_3O_8 IN DETRITAL MONAZITE FROM NORTH CAROLINA AND SOUTH CAROLINA, USA. Overstreet, W. C.; Warr, J. J. Jr.; White, A. M. (United States Geological Survey, Washington, D. C.). pp 143-153 of Proceedings of the Second Seminar on Geochemical Prospecting Methods and Techniques. New York; United Nations (1970).

From 2nd seminar on geochemical prospecting methods and techniques; Peradeniya, Ceylon (10 Sep 1970). See CONF-700988-.

Chemical analyses for ThO_2 and U_3O_8 content in 81 sized fractions of detrital monazite from 33 drainage basins in North Carolina and South Carolina disclosed a strong tendency for the percentage of ThO_2 to vary according to particle sizes of monazite at each locality. Higher percentages of ThO_2 are associated with coarse-grained monazite than with fine-grained monazite. This relation for thorium is thought to result from the tendency of certain grain-size ranges of the detrital monazite to be associated with the origin of the monazite in specific rock units. The role of size in relation to tenor of U_3O_8 was not fully brought out by the study, owing possibly to the use of too small a separation in size of grain. Differences in percentage of U_3O_8 were greater than those that could be attributed to analytical procedure, and more analyses are required to define the trends of these differences. A preparator's tendency to select coarse detrital grains of monazite if a choice lies among grains of diverse size can, therefore, introduce a bias in the reported tenor in ThO_2. However, knowledge that the composition of a detrital mineral may vary with grain size and that grain-size distribution tends to vary by rock type might actually be used to advantage in geochemical exploration. (auth)

9492 GEOCHEMISTRY OF MONAZITE FROM MADAGASCAR. Serre-Ratsimandisa, R. pp 154-161 of Proceeding of the Second Seminar on Geochemical Prospecting Methods and Techniques. New York; United Nations (1970).

From 2nd seminar on geochemical prospecting methods and techniques; Peradeniya, Ceylon (10 Sep 1970). See CONF-700988-.

Results obtained from the determination of the heavy members of the rare-earth group of elements and from the measurements of radioactivity made on 274 samples of monazite collected during alluvial prospecting of an area of about 30,000 sq km in the southern part of Madagascar are presented. Data are presented on the monazite samples in terms of their content of the yttrium earths. The data are compared with information obtained by means of geophysical and geochemical investigations of alluvium. By the discovery of an ore deposit of europium and the yield of complementary data on the geologic environment, the study demonstrates the practical usefulness of the geochemistry of a specific mineral. (auth)

9493 GEOCHEMICAL DATA ON THE URANIFEROUS PHOSPHORITES OF MUSSOORIE, DEHRA DUN DISTRICT, UTTAR PRADESH, INDIA. Saraswat, A. C.; Varada Raju, V.; Taneja, P. C.; Bargaja, V. B.; Sankaran, A. V. (Dept. of Atomic Energy, Bombay). pp 179-187 of Proceedings of the Second Seminar on Geochemical Prospecting Methods and Techniques. New York; United Nations (1970).

From 2nd seminar on geochemical prospecting methods and techniques; Peradeniya, Ceylon (10 Sep 1970). See CONF-700988-.

Samples of phosphorite from the Mussoorie area in the Dehra Dun district were transmitted in 1967 for analyses for uranium. The samples were uraniferous and contained as much as 0.1 per cent eU_3O_8, considerably higher than amounts in other phosphorites. phorites. Following this discovery, a systematic investigation of the phosphorite beds and associated rocks was undertaken by the Atomic Minerals Division, Department of Atomic Energy, to assess their uranium potential. Spectrographic analyses of associated trace methals were made as a part of the investigation. (auth)

Radioactive Effluents

Refer also to abstracts 10842 and 12062.

9494 (BNWL-B-274) INTERIM REPORT: THE FRACTIONAL AIRBORNE RELEASE OF DISSOLVED RADIOACTIVE MATERIALS DURING THE COMBUSTION OF 30 PERCENT NORMAL TRIBUTYL PHOSPHATE IN A KEROSINE-TYPE DILUENT. Mishima, J.; Schwendiman, L. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1973. Contract AT(45-1)-1830. 16p. Dep. NTIS $4.00.

Laboratory-scale experiments were performed to indicate the fraction of uranium and certain fission products made airborne during a fire involving contaminated, flammable solvents. Small quantities of 30% normal tributyl phosphate in a kerosene diluent containing Purex process-representative concentrations of selected radioactive elements, uranium, cesium, zirconium, cerium, and iodine, were burned in an upsweep of air and the fractional release measured. Nominal velocities in the 2.7-in. stainless steel chimney exhausting gases from the combustion vessel were 25 and 59 feet per minute. Sixty-five percent of the iodine was released when the liquid burned in a self-sustaining flame up to the point of self-extinguishment. Further heating to a char resulted in a total release of about 83%. One percent or less of other elements was released even when the vessel was heated externally with a propane torch following the self-sustaining burning period. (auth)

9495 (BNWL-SA-4837) ATMOSPHERIC RAIN WASHOUT OF ELEMENTAL GASEOUS IODINE. Mahalingam, R.; Hales, J. M.; Schwendiman, L. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 49p. (CONF-740705-2). Dep. NTIS $5.50.

From thermophysics and heat transfer conference; Boston, Massachusetts, USA (15 Jul 1974).

There is a possibility of radioiodine release in the event of a loss of coolant accident (LOCA) in nuclear reactors used for power generation. Radioiodine is also released to the atmosphere during atmospheric nuclear testing. Its dilution and removal from the atmosphere by natural processes are important considerations in evaluating the potential radiological effects on man. Any release of iodine radioisotopes to the atmosphere by the above two sources can be washed down to the earth by natural precipitation. The

analytical modelling of rain washout is discussed and compared with the scanty experimental data available in the literature. (CH)

9496 (COO-2053-3) GASEOUS DISPERSION INTO STRATIFIED BUILDING WAKES. Yang, B. T.; Meroney, R. N. (Colorado State Univ., Fort Collins (USA). Fluid Dynamics and Diffusion Lab.). Aug 1970. Contract AT(11-1)-2053. 114p. Dep. NTIS $8.75.

The dispersion of gases in the atmospheric boundary layer released from an elevated source may be predicted by numerous semi-empirical formulas; however, very little information is available to describe the dispersion within the cavity-wake region downwind of a leaking structure. Results are reported of the first wind tunnel phase of a joint field and wind tunnel program in which ^{85}Kr was used as a tracer to evaluate the wind tunnel as a site analysis tool for nuclear safety investigations. A series of diffusion measurements are tabulated for a simple cubical structure placed at different orientations in a stratified shear layer. (auth)

9497 (EPA-600-5-74-5) DEVELOPMENT OF PREDICTIONS OF FUTURE POLLUTION PROBLEMS. Flinn, J. E.; Reimers, R. S. (Battelle Columbus Labs., Ohio (USA)). Mar 1974. Contract 68-01-1837. 217p. GPO $2.40.

Results are described of a program to identify, rank, and project short- and intermediate-term future pollution problems. Identification was accomplished using three independent search approaches based on industrial production, environmental, and societal trends and activity. An initial list of problems was compiled with specific stressors identified with each. Nine ranking factors were devised to select ten most serious problems from the initial list. The factors included: persistence; mobility/pervasiveness; environmental, technological, social, and political complexity; physiological risk; research needs; and bulk or volume of the pollutant. The ten problems selected by this method were ranked in order of relative importance and included critical radiation problems in seventh place. It is pointed out that radioactive substances from fallout associated with nuclear testing have been a concern in the past, but that radium and strontium, for which USPHS standards exist, and tritium, for which no USPHS standards exist, are the elements of current interest. (CH)

9498 (NP-20037) PRODUCTION AND RELEASE OF RADIOIODINES BY NUCLEAR POWER PLANTS AND REPROCESSING PLANTS AND THE EXPECTED RADIOLOGICAL BURDEN TILL THE YEAR 2000. Porz, F. (Karlsruhe Univ. (TH) (F.R. Germany). Inst. fuer Physikalische Grundlagen der Reaktortechnik; Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Jul 1973. 82p. (In German). Dep. NTIS (US Sales Only) $7.25.

The natural production of radioiodines is summarized in this report together with the yields from nuclear weapons and nuclear facilities. Specific production rates and the consequent release rates representative of time are evaluated for the different types of nuclear power plants. Release rates from fuel reprocessing plants are also included. For a 1500-t/a reprocessing plant a decay-decontamination factor-study was performed with the condition that a dose of 90 mrem/a is not exceeded for any release. Based on the forecasted onset of nuclear facilities till the year 2000, the time-dependent production rates as well as the global inventory are calculated. (auth)

9499 (UCRL-75250) EVALUATION OF THE RESUSPENSION PATHWAY TOWARD PROTECTIVE GUIDELINES FOR SOIL CONTAMINATION WITH RADIOACTIVITY. Anspaugh, L. R.; Shinn, J. H.; Wilson, D. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 May 1974. 18p. (CONF-740529-2, SM-184-13). Dep. NTIS $4.00.

From seminar on radiological safety evaluation of population doses and application of radiological safety standards to man and the environment; Portoroz, Yugoslavia (20 May 1974).

The resuspension and subsequent inhalation of surface-deposited radioactivity released to the environment can be a significant mode of exposure for a few radionuclides such as ^{239}Pu. Two simple, interim models, which may be used to predict the average concentration of resuspended aerosols, were developed on an empirical basis. One method used the time-dependent resuspension factor approach, and differs from previous work in placing more emphasis on resuspension at late times. The second method is appropriate only for aged sources, and uses a straightforward mass-loading approach. The relative significance of the resuspension pathway is also modeled in comparison to the initial exposure resulting from a nonnuclear explosion that disperses radioactivity. Two hypothetical ^{239}Pu contamination situations are modeled. In the first case the 50 yr dose commitment resulting from an initial deposition of 1 $\mu Ci/m^2$ is calculated as a function of time post deposition. Half of the total dose commitment is accumulated in the first 100 d. In the second situation, the reoccupation of an area contaminated many years previously is considered. Protective guidelines for ^{239}Pu soil contamination are derived from these studies (1 $\mu Ci/m^2$ for a freshly deposited source and 7 nCi/g in the top 10 mm of soil for a source which has aged several years). An estimate of the biological cost of not cleaning up contaminated areas is compared with the engineering and agricultural costs of soil removal. (32 references) (auth)

9500 MAN'S IMPACT ON THE GLOBAL ENVIRONMENT. Assessment and Recommendations for Action. Cambridge, MA; Massachusetts Institute of Technology Press (1970). 341p. $12.50.

Approximately 40 scientists participated in a study of critical environmental problems, sponsored by the Massachusetts Institute of Technology during the entire month of July 1970. Topics discussed included the climatic effect of man's activities, the ecological effects of man's activities, and implications of changes and remedial action. Recommendations developed by seven work groups are included. It was concluded that, although by the year 2000 global thermal power output may be as much as six times the present level, no affect on global climate is expected. One of the areas not covered by intensive study was the management of large quantities of radioactive wastes from nuclear power plants. It was concluded that no other environmental pollutant has been so carefully monitored and that additional recommendations are not needed at the present time. (CH)

9501 BIOLOGICAL EFFECTS OF THE EMISSION OF NOXIOUS SUBSTANCES FROM INDUSTRIAL PLANTS, PARTICULARLY FROM POWER PLANTS. Meissner, J. (Forschungsinstitut, Borstelt, Ger.). (1973). vp. (In German).

From VGB conference on power plant and environment; Essen, Germany (27 Feb 1973).

In general it is extremely difficult to prove that injury to health occurred as a consequence of the continuous emission of noxious substances. The present article reviews experiments that have been made to establish scientifically well-founded correlations between defined biological effects and concentrations of noxious substances varying with time and site. The question as to what extent animal experiments are relevant for man is also discussed. The preoblems discussed are restricted to chemical noxious substances and the radiobiological risk. (GE)

Radioactivity Monitoring and Transport

Refer also to abstracts 9800, 9807, 9986, 11446, and 12094.

9502 (AAEC/E-286) SITE EMERGENCY RELEASES AND SITE EMERGENCY STOCKS: RECOMMENDED VALUES FOR USE AT THE RESEARCH ESTABLISHMENT. Cook, J. E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1974. 41p. Dep. NTIS (US Sales Only) $5.25.

Figures are given for the quantities of hazardous materials which, if released to atmosphere or if involved in an accident capable of leading to a release to atmosphere at the Australian Atomic Energy Commission Research Establishment, Lucas Heights, are the minimum amounts which could give rise to a situation requiring appraisal by the Site Emergency Organization. Such a situation is defined as one in which potential involuntary exposures of individuals to radiation and radioactive materials may involve a subsequent risk to the exposed individual of long term adverse somatic effects (e.g. carcinogenesis) in excess of 10^{-4}. The circumstances of an accident involving more than a site emergency stock must be investigated immediately to evaluate actual risks and to initiate emergency action if necessary. The dependence of such an evaluation on the physical and chemical forms of the material, its containment and prevailing weather conditions is described in general terms. (auth)

9503 (BNWL-1811) ENVIRONMENTAL SURVEILLANCE AT HANFORD FOR CY-1973. Nees, W. L.; Corley, J. P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1974. Contract AT(45-1)-1830. 85p. Dep. NTIS $5.45.

The 1973 Hanford Environmental Surveillance Program showed continued compliance of the Hanford contractors and their operations with applicable environmental standards. The shutdown of the last of the single-pass cooled production reactors (KE) in January of 1971 eliminated the major remaining source of population exposure from Hanford operations. In 1973, the average Columbia River radionuclide concentrations were less than 0.5%

of the Concentration Guides for all identified radionuclides. The difference in observed gross alpha activity between Vernita and Richland averaged 0.4% of the Concentration Guide for unidentified alpha emitters. Biological and chemical measurements indicated an addition of coliform organisms (14% of standard) and BOD (no standard) between measurement points which was due to non-plant sources. There was no measurable contribution to nitrate. Maximum river temperature was 21.0°C, and there was a net increase in river temperature of about 0.2°C between Priest Rapids and Richland. Average concentrations in Richland sanitary water were less than 1% of the Concentration Guides for radionuclides except for unidentified alpha emitters, which were 2.3% of the Concentration Guide. As indicated above, most of the alpha activity does not originate from Hanford operations. Nitrate in Richland sanitary water was 2% of the standards. Tritium and nitrate concentrations in four off-site wells were less than 0.1 and 1%, respectively, of the applicable standards. Airborne radioactivity concentrations at the Hanford boundary were, on the average, the same as the more distant sampling locations, indicating that Hanford operations did not contribute detectably to off-site airborne radioactivity. Average airborne beta, alpha, and ^{131}I concentrations were 0.4, 4.0, and <1%, respectively, of the Concentration Guides for 1973. Airborne NO_2 and SO_2 were 14% and less than 20% of the respective standards. A number of foodstuffs were sampled and analyzed for radioactive content. Average concentrations of ^{65}Zn, ^{90}Sr, ^{131}I, and ^{137}Cs in local milk were less than 1% of the Concentration Guide for water. Trace radionuclides were also measured in local meat, poultry, eggs, produce, gamebirds, whitefish, and Willapa Bay oysters. There are no applicable Concentration Guides for these foods, but calculated doses from consumption of such foods were less than 1 mrem. Zinc-65 concentration in the oysters decreased through 1973 at a rate closely corresponding to its radioactive decay rate and averaged 0.6×10^{-6} μCi/gm in 10 samples. Soil and vegetation samples were analyzed for plutonium, uranium, ^{90}Sr, and gamma emitters. Individual results showed no particular geographical pattern and the concentrations are believed to be the result of natural occurrence and regional fallout from past nuclear weapons tests. Local plutonium concentrations are typical of arid western states. The average external radiation exposure rate in the vicinity of Hanford was about 0.19 mR/day. The immersion exposure rate in the Columbia River at Richland averaged 0.14 mR/day, and the Columbia River shoreline exposure rate averaged 0.26 mR/day at Richland. Residual contamination from previous reactor operations was measured on several islands but has minimal dose implications. Estimated 1973 dose to the average Richland resident from Hanford sources was less than 1 mrem (<0.6% of the standard), about the same as for 1972. (auth)

9504 (COO-1156-70) RADIOECOLOGY OF SOME NATURAL ORGANISMS AND SYSTEMS IN COLORADO. Twelfth Technical Progress Report, May 1, 1973–April 30, 1974. Whicker, F. W. (Colorado State Univ., Fort Collins (USA), Dept. of Radiology and Radiation Biology). 1 May 1974. Contract AT(11-1)-1156. 74p. Dep. NTIS $6.75.

The broad purpose of this research is to provide information on the behavior of radionuclides in, and radiation sensitivity of, selected organisms and natural ecosystems in Colorado. Components of alpine tundra, montane forests, shortgrass plains, and freshwater lakes and streams are currently under investigation with respect to behavior and effects of radionuclides. This report summarizes experiences during the past year at Rocky Flats with regard to field sampling, sample processing, analytical procedures, biotic inventories, and initial surveys of ^{238}Pu and ^{239}Pu in soil, litter, vegetation, and animals. A five-year study on the kinetics and distribution of ^{85}Sr administered in $^{85}SrCl_2$ in drinking water in captive mule deer (Odocoileus hemionus) was completed and data are summarized. The goal of this study was to develop a model of strontium accumulation in deer of various ages under specified circumstances of season, including modifications due to antler growth and lactation. As a part of long-term studies on the persistence of fallout ^{137}Cs in mule deer, tissues from several animals collected in July and December, 1973, were assayed for ^{137}Cs. Essentially all of our earlier studies on fallout ^{137}Cs in mule deer and on metabolism of cesium in captive animals culminated in a model capable of providing realistic estimates of forage consumption rates in free-roaming deer. Additional interpretations of inert tracer data were also made to estimate rate of ingesta passage in captive deer for radionuclide modeling purposes. The large ^{137}Cs γ source at the Pawnee Grassland is still active and chronic irradiation initiated in April, 1969 is continuing. The plant community was inventoried again in 1973 and a detailed study on soil microorganisms and soil chemistry across the chronic irradiation gradient was completed. Energy flow from the dominant grass of the shortgrass plains, Bouteloua gracilis, through arthropod consumers was investigated by tagging the grass with ^{32}P and tracing its movement into primary and secondary consumers. Feeding rates of three common grasshopper species were measured from data on accumulation and retention of ^{32}P from contaminated herbage. Studies on ^{137}Cs levels in mountain lake waters and fish throughout Colorado continued, primarily to document long-term fallout cesium behavior in selected lakes. (CH)

9505 (COO-3011-3) RADIOACTIVE FOODCHAINS IN THE SUBARCTIC ENVIRONMENT. Technical Progress Report, 15 August 1973–14 August 1974. Clayton, R. K. (Helsinki Univ. (Finland). Dept. of Radiochemistry). 1974. Contract AT(11-1)-3011. 73p. Dep. NTIS $6.75.

Fallout levels of ^{137}Cs in Finnish Lapland during 1966–1973 in the food chain lichen-reindeer-man and body burdens of ^{137}Cs in Finnish Laps in March 1974 are given. Radioactivity in plants and lichens (1973) and reindeer muscle (1974) is reported. Results of analysis of lichen and reindeer tissue samples for $^{239,240}Pu$ and ^{238}Pu from 1960–1973 are presented. (LK)

9506 (DPSP-55-25-34(Del.)) REGIONAL MONITORING GROUP, HEALTH PHYSICS SECTION SEMIANNUAL PROGRESS REPORT, JULY–DECEMBER 1954. Horton, J. H. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). Sep 1955. 33p. Dep. NTIS $4.75.

Background data are compared with the level of radioactivity at various sampling locations from July through December 1954. Of particular interest are the findings on concentration increases in stream water, mud, and zoological samples due to plant operations; and the increases in vegetation and atmospheric samples due to fallout from 1954 Pacific and 1954 Russian tests. (auth)

9507 (DPSP-56-25-54(Del.)) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JULY–DECEMBER 1955. Horton, J. H.; Mealing, H. G. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). 26 Oct 1956. 44p. Dep. NTIS $5.25.

Radioactivity in the various types of samples from the environs of the Savannah River Plant from July 1955 through December 1955 is compared with the radioactivity in similar samples collected during the previous six months. Bomb fallout was negligible in comparison to the previous six months, but indications of contamination from Plant operations were more numerous. (auth)

9508 (DPSP-57-25-4(Del.)) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JANUARY–JUNE 1956. Horton, J. H.; Mealing, H. G. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). 26 Feb 1957. 38p. Dep. NTIS $5.00.

Radioactivity in various types of samples from the environs of the Savannah River Plant from January 1956 through June 1956 is compared with radioactivity in similar samples collected during the previous six months. Radioactive contamination from both Plant operations and bomb fallout was detectable throughout most of this report period. Compared to previous periods, there was very little radioactivity from bomb fallout, while contamination from Plant operations continued to increase. (auth)

9509 (DPSP-57-25-43(Del.)) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JANUARY–JUNE 1957. Mealing, H. G. Jr.; Horton, J. H. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). 20 Nov 1957. 43p. Dep. NTIS $5.25.

Radioactivity from both Plant operations and bomb fallout was detectable throughout the period from January 1957 through June 1957. As compared to the previous report period, nonvolatile beta concentrations in reactor effluent streams increased, while environmental radioactivity resulting from stack releases decreased during this period. (auth)

9510 (DPSP-58-25-17(Del.)) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JULY–DECEMBER 1957. Mealing, H. G. Jr.; Harvey, R. S. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). 15 Jul 1958. 50p. Dep. NTIS $5.50.

Radioactivity from both Plant operations and bomb fallout was detectable during the period from July 1957 through December 1957; bomb fallout was estimated to be approximately three times greater than during the previous 6-month period. Nonvolatile beta released to reactor effluent streams was readily detectable in the Savannah River, and more extensive biological sampling of the reactor effluent streams was begun. Nonvolatile beta discharged to R-Area seepage basins exceeded the previous total nonvolatile beta release to all Savannah River Plant seepage basins. (auth)

9511 (DPSP-60-25-26(Del.)) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JANUARY–JUNE 1960. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C.

(USA). Atomic Energy Div.). Oct 1960. 56p. Dep. NTIS $6.00.

Radioactivity in the Plant environs was measured during the six-month period ending June 30, 1960. Nonvolatile beta releases from Reactor Areas to effluent streams and alpha releases from stacks in the Separations Areas increased during the report period. No significant amounts of radioactivity were detected in the environment as a result of Plant discharges. Arrival of fresh bomb debris from a French nuclear weapon test was noted. (auth)

9512 (DPSP-61-25-4(Del.)) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JULY–DECEMBER 1960. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). Oct 1961. 56p. Dep. NTIS $6.00.

Radioactivity in the Plant environs was measured during the six-month period ending December 31, 1960. No significant amounts of radioactivity were detected in the environment as a result of Plant discharges. Nonvolatile beta releases from Reactor Areas to effluent streams decreased approximately 70%. Nonvolatile beta and alpha releases from F-Area stacks increased while decreased releases were observed from H-Area stacks. The six-month average concentration of nonvolatile beta activity in air was the lowest observed to date. (auth)

9513 (DPSP-62-25-2(Del.)) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JANUARY–JUNE 1961. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). Feb 1962. 68p. Dep. NTIS $6.50.

Radioactivity in the Plant environs was measured during the six-month period ending June 30, 1961. Releases of alpha emitters, nonvolatile beta emitters, and tritium to effluent streams increased, while such releases to the atmosphere decreased. Radioiodine released to the atmosphere–the highest six-month total observed since 1957–was attributed almost entirely to that released from the Building 291-F stack. (auth)

9514 (DPSP-62-25-9(Del.)) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JULY–DECEMBER 1961. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). May 1962. 67p. Dep. NTIS $6.50.

Radioactivity in the environs of the Savannah River Plant was measured during the six-month period ending December 31, 1961. There was a decrease in the amount released of alpha emitters, nonvolatile beta emitters, and radioiodine from Plant facilities to the environs, via the stacks, stream effluents, and seepage basins. Filterable beta emitters in atmospheric samples were attributed almost entirely to fallout from Soviet weapons tests. Weapons–produced radioiodine in milk was the principal source of radiation exposure. (auth)

9515 (DPSP-63-25-3(Del.)) HEALTH PHYSICS ENVIRONMENTAL MONITORING SEMIANNUAL REPORT, JANUARY–JUNE 1962. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). Feb 1963. 50p. Dep. NTIS $5.50.

Radioactivity in the environs of the Savannah River Plant was measured during the six-month period ending June 30, 1962. Fallout from nuclear weapons testing was evident in nearly all phases of the regional monitoring program. Atmospheric samples showed no filterable beta activity above levels attributable to bomb fallout. Releases of radioactive materials to the atmosphere and to Separations Areas seepage basins increased slightly. Increases from Reactor Area to Plant streams were associated with a fuel element failure and the recognition of sulfur-35 in releases during routine reactor discharges. Radioiodine releases resulting from discharge of the failed element were detectable for a short time in the Savannah River. (auth)

9516 (DPSPU-59-11-23) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JULY–DECEMBER 1958. Harvey, R. S.; Horton, J. H.; Mealing, H. G. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). Aug 1959. 46p. Dep. NTIS $5.50.

Radioactivity in the Plant environs from Plant operations and from bomb fallout was detected during this 6-month period. Radioiodine released from the Separations Areas was detected in air and on vegetation; nonvolatile beta activity released by the Reactor Areas was detected in Plant streams and in the Savannah River. Bomb fallout during October, November, and December originating from both the U. S. Nevada tests and the Soviet weapons tests was atypical, in that maximum concentrations observed were not as great as expected, but moderately high concentrations persisted through December 1958. (auth)

9517 (DPSPU-59-11-30) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JANUARY–JUNE 1959. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). Nov 1959. 41p. Dep. NTIS $5.25.

Radioactivity in the Plant environs from Plant operations and from bomb fallout was detected during this six-month period. The six-month average concentration of nonvolatile beta activity released from the Reactor Areas to Plant streams, and from weapons test debris in air, was the highest observed to date. (auth)

9518 (DPSPU-60-11-9) HEALTH PHYSICS REGIONAL MONITORING SEMIANNUAL REPORT, JULY–DECEMBER 1959. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). Jun 1960. 44p. Dep. NTIS $5.25.

Radioactivity in the Plant environs was measured during the six-month period ending December 31, 1959. Although radioactivity released to effluent streams from Reactor Areas decreased slightly, nonvolatile beta radioactivity discharged from stacks in the Separations Areas increased by a factor of 3. The contribution of radioactivity due to fallout from nuclear weapons tests decreased to the lowest level observed to date. A routine survey program to determine the chemical quality of Savannah River water was initiated. (auth)

9519 (DPSPU-64-11-12) HEALTH PHYSICS REGIONAL MONITORING ANNUAL REPORT, 1963. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). Jun 1964. 39p. Dep. NTIS $5.00.

Results obtained from the environmental monitoring program conducted at the Savannah River Plant during 1963 are reported. (LCL)

9520 (DPSPU-72-302) ENVIRONMENTAL MONITORING AT THE SAVANNAH RIVER PLANT. Annual Report, 1971. Ashley, C. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Plant). Sep 1972. 29p. Dep. NTIS $4.50.

Results obtained from the environmental monitoring program at the Savannah River Plant during 1971 are summarized. Releases of radioactive materials from the separations and reactor areas and a brief discussion of environmental radioactivity are presented in the text and tables. (LCL)

9521 (DPSPU-73-302) ENVIRONMENTAL MONITORING AT THE SAVANNAH RIVER PLANT. Annual Report, 1972. Ashley, C.; Zeigler, C. C. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Plant). Aug 1973. 33p. Dep. NTIS $4.75.

This report summarizes results obtained from the environmental monitoring program at the Savannah River Plant (SRP) during 1972. A brief discussion of plant releases to the environment and radioactivity detected in the environment is presented. The appendix contains tables of results from environmental sample analyses, sensitivities of laboratory analyses, and maps of sampling locations. Comparisons with 1971 showed reactor liquid releases reduced 65% for ^{137}Cs and 81% for ^{90}Sr. Separations areas liquid releases of ^{137}Cs to seepage basins equaled the 1971 total; however, ^{90}Sr releases decreased 44%. The annual plant contribution of ^{137}Cs in Savannah River water decreased from 1.24 Ci to 0.45 Ci and ^{90}Sr decreased from 2.52 Ci to 1.62 Ci. Tritium releases continued to be dependent on operating modes and schedules. Stack releases increased 20% over 1971 in reactor areas and 38% in separations areas. Liquid tritium releases increased 36% in reactor areas and 17% in separations areas. A moderator leak in Building 420-D caused a release of 4200 Ci of tritium to the effluent stream in December. The plant contribution of tritium to the Savannah River increased from 39,000 Ci in 1971 to 45,000 Ci in 1972. An increased fission product release, primarily ^{144}Cs, ^{89}Sr, and ^{90}Sr, from the H-Area stack occurred in July-August as a result of the mode of operation of the 6.1 dissolver. A leak in a HB-Line precipitator caused increased H-area releases of α activity (primarily ^{238}Pu to Four Mile Creek). Processing of longer cooled fuel in separations areas reduced ^{131}I stack releases by 90% (26.6 to 2.7 Ci). Plutonium-238-239 stack releases decreased from 30 mCi in 1971 to 20 mCi in 1972. Total release of natural, enriched, and depleted uranium from the fuel preparation area to the effluent stream was 0.39 Ci in 1972 versus 0.35 in 1971. Mercury discharges to the separations areas seepage basins came under routine observation in September 1970 and data for 1972 are included. (auth)

9522 (DPSPU-74-30-1) ENVIRONMENTAL MONITORING IN THE VICINITY OF THE SAVANNAH RIVER PLANT. Annual Report for 1973. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Plant). 1973. 31p. Dep. NTIS $4.75

A continuous monitoring program has been maintained since 1951 (before plant startup) to determine the concentrations of radioactive materials in a 1200-square mile area outside the Savannah River Plant. Although some gaseous and liquid radioactive materials are discharged from SRP operations, concen-

trations and doses to the surrounding population during 1973 continued to be far below levels considered significant from a public health viewpoint. (auth)

9523 (EUR-5118) ENVIRONMENTAL RADIOACTIVITY, ISPRA 1972. de Bortoli, M.; Gaglione, P. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Apr 1974. 63p. Dep. NTIS (US Sales Only) $6.25.

The activity of the site survey group of the Protection Division at the Euratom Joint Research Centre–Ispra Establishment from January through June 1973 is reported. The group works on the radiation protection of the population concerned by the radioactive effluents of the Establishment; some determinations are performed also on non-radioactive pollutants. Results of the measurements carried out directly on the effluents as well as in the environment in order to assess the contribution by the Establishment to the population dose and the pre-existing radiation and contamination levels of natural origin and those due to world-wide fallout are presented. The results of the determinations carried out in the field of non-radioactive pollution are also reported. (auth)

9524 (INIS-mf-887-1, pp 118-134) DETERMINATION OF RADIOACTIVE CONTAMINATION ON ENVIRONMENT BY LIQUID SCINTILLATION SPECTROMETRY. Prochazka, H.; Jilek, R.; Katzer, J.; Hulak, P. (Vyzkumny Ustav Veterinarniho Lekarstvi, Brno-Medlanky). [nd]. (In Czech).

A simple mathematical method is presented of determining the value of the total mean energy of mixed samples by means of interaction of nuclear radiation with a liquid scintillator. The method offers a number of advantages, mainly in the control of contaminated water discharge, viz., a speedy sample preparation, accuracy and reproducibility in a possible automated measurement, a small initial volume for sample preparation. (INIS)

9525 (IS-3313) SURVEY OF ENVIRONMENTAL RADIOACTIVITY, JANUARY 1–DECEMBER 31, 1973. Voss, M. D. (Ames Lab., Iowa (USA)). May 1974. Contract W-7405-eng-82. 56p. Dep. NTIS $5.45.

The environmental monitoring program of the Ames Laboratory of the USAEC, including the Ames Laboratory Research Reactor (ALRR), is discussed. The environmental program consists of determinations of gross α and β radioactivity in air, soil, vegetation, river water, ALRR outfall, bottom sediment, precipitation, well water, and pond water samples. The ALRR reached full power as of 7/12/65 and had generated 198,571 megawatt hours as of 12/31/72. A total of 32,696 megawatt hours was generated in 1973. Off-site environmental air is routinely monitored at a station atop Spedding Hall, Iowa State University campus, Ames, Iowa. The average radioactivity concentration in air for 1973 was $< 4.6 \times 10^{-15}$ μCi/ml α and 4.4×10^{-13} μCi/ml β. This is the normal background at the sampling location. There was no measurable increase in airborne radioactivity attributable to Ames Laboratory operations. The α and β radioactivity in stream water was determined upstream and downstream from the confluence point of streams forming the drainage pattern from the ALRR. The average concentration during 1973 for all samples not in the direct flow (upstream) was 1.15×10^{-9} μCi/ml α and $< 5.79 \times 10^{-9}$ μCi/ml β. In the direct flow pattern (downstream) the average concentration was 1.05×10^{-9} μCi/ml α and 5.23×10^{-9} μCi/ml β. There was no measurable radioactivity in the stream water samples attributable to Ames Laboratory operations. (auth)

9526 (LA-UR-74-764) BIOLOGICAL TRANSFER PROCESSES IN ENVIRONMENTAL SURVEILLANCE. Hanson, W. C. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. 7p. Dep. NTIS $4.00.

The need for long-term radiation ecology studies in order to provide a reliable basis for assessing, predicting, and demonstrating the public health hazards due to the discharge of radioactive effluents from nuclear power plants is discussed. (LCL)

9527 (ORNL-EIS-74-68) ENVIRONMENTAL TRANSPORT OF CHEMICALS BIBLIOGRAPHY. Wilkinson, B. K.; Corrill, L. S.; Copenhaver, E. D. (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W-7405-eng-26. 187p. Dep. NTIS $12.50.

The bibliography presents 1019 citations to literature on environmental transport of chemicals. Author and keyword indexes are included. (ERB)

9528 (PNE-RB-51-7) RADIOLOGICAL MONITORING PROGRAM, PERIOD COVERING AUGUST 1, 1973 THRU OCTOBER 31, 1973 FOR CER GEONUCLEAR CORPORATION, PROJECT RIO BLANCO. (Eberline Instrument Corp., Santa Fe, N. Mex. (USA)). [nd]. 23p. Dep. NTIS $4.25.

Beta radioactivity in air particulate samples for this quarter remained at very low concentrations, ranging from 0.02 to 0.05 pCi/m^3. These values are consistent with values observed by Eberline at other sites during this period, at Rio Blanco during previous periods, and with values reported by the Environmental Protection Agency (EPA) Air Surveillance Network. Gamma scans of the air particulate samples (composite) indicated that the concentrations of gamma emitters were below the minimum sensitivity of the 4" diameter × 4" thick NaI (Tl) detector. TLD data for this period indicated an average background radiation dose rate of 2.7 millirem per week. This is consistent with the dose rate measured in 1972. Beta radioactivity in surface water ranged from 0.0 to 8.8 pCi/l. Tritium concentration measured by electrolytic enrichment were in the range of 0.1 to 0.5 pCi/ml. Gamma scans indicated no detectable activity above background and system sensitivity. Gamma scan analysis of milk indicated no significant concentration of gamma emitters except natural potassium. The tritium concentration in water recovered by distillation from soil samples was less than 1 pCi/ml. No gamma emitters other than natural thorium, uranium, and potassium were detected except for Cs-137, ranging from less than 0.04 to 1.18 pCi/g dry weight, due to worldwide fallout. The concentration of Sr-90 in vegetation samples ranged from 0.10 to 0.64 pCi/g dry weight. The tritium concentration in water recovered by distillation was less than 1 pCi/g. No gamma emitters were detected other than natural potassium. Several fish samples were analyzed. The concentration of Sr-90 ranged from 0.03 to 0.60 pCi/g dry weight of the edible portion of fish. One fish sample was analyzed for tritium. The tritium concentration was less than 1 pCi/g. The gamma analysis of fish indicated no significant concentrations of gamma emitters except natural potassium. Deer meat samples were analyzed for Sr-89 and Sr-90, tritium and gamma scan. The concentrations of Sr-89 and Sr-90 were <0.05 and 0.02 pCi/g dry weight respectively. The tritium concentration in water recovered by distillation was less than 1 pCi/g. No gamma emitters were detected other than natural potassium. None of the results obtained during this period differed significantly from expected levels. (auth)

9529 (PNE-RB-51-8) RADIOLOGICAL MONITORING PROGRAM, PERIOD COVERING NOVEMBER 1, 1973 THRU FEBRUARY 4, 1974 FOR CER GEONUCLEAR CORPORATION, PROJECT RIO BLANCO. (Eberline Instrument Corp., Santa Fe, N. Mex. (USA)). [nd]. 19p. Dep. NTIS $4.00.

Beta radioactivity in air particulate samples for this period remained at very low concentrations, ranging from 0.02 to 0.13 pCi/m^3. Gamma scans of the air particulate samples (composite) indicated that the concentrations of gamma emitters were below the minimum sensitivity of the 4" diameter × 4" thick NaI (Tl) detector. TLD data for this period indicated an average background radiation dose rate of 2.25 millirem per week. This is consistent with the dose rate measured during the previous winter. Lower dose rates during the winter are attributable to attenuation of radiation from terrestrial sources due to snow cover. Soil samples collected in November, 1973 were analyzed for isotopes of plutonium, uranium, and thorium. The concentration of plutonium was within the range of expected values due to worldwide fallout. The concentrations of uranium and thorium were within ranges that occur naturally. (auth)

9530 (TID-26578) ENVIRONMENTAL MONITORING REPORT, 1973. (General Electric Co., St. Petersburg, Fla. (USA). Pinellas Peninsula Plant). 1 Apr 1974. 25p. Dep. NTIS $4.25.

Results are summarized for the effluent and environmental monitoring programs at the Pinellas Plant during 1973. Small quantities of tritium gas, tritium oxide, and ^{85}Kr gas were released from the plant during the year. Average ground level concentrations of these radioisotopes were all significantly less than 1% of recommended guide for continuous non-occupational exposure. Analyses of two hundred and seven off-site surface water samples obtained in all directions from the plant to a distance of six miles revealed no detectable tritium concentrations. Calculations were made to determine the radiation doses resulting from releases of tritium to: an individual at the site boundary; individuals in the closest residential area; and the population within fifty miles of the plant site. The results showed the doses to be 0.01%, 0.005% and 0.00094% respectively of the recommended standards. (auth)

9531 (UCRL-75644(Rev. 1)) ATMOSPHERIC RELEASE ADVISORY CAPABILITY. RESEARCH AND PROGRESS. Knox, J. B.; Crawford, T. V. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 May 1974. 33p. (CONF-740406-13). Dep. NTIS $4.75.

From second AEC pollution control conference; Albuquerque, New Mexico, USA (16 Apr 1974).

Progress is reported in the development of a real-time capability to predict the effects, including dose-to-man, from a large scale accidental release of radioactivity that might arise from

the growing nuclear power industry and/or other activities of the AEC, and to explore the use of this capability in AEC surveillance and assessment programs. The present status in regard to the prototype system and results of initial tests of the system in a joint effort between the Lawrence Livermore Laboratory and the Savannah River Laboratory are reviewed. (CH)

9532 SOME CHARACTERISTICS OF THE DISTRIBUTION OF ION CONCENTRATION AND OF THE ACTIVITY OF SHORT-LIVED RADON INDUCTIONS OVER THE TERRITORY OF GEORGIA. Amiranshvili, A. G.; Nodiya, A. G.; Khundzhua, T. G. (Inst. of Geophysics, Tbilisi, USSR). Soobshch. Akad. Nauk Gruz. SSR; 73: No. 3, 589-592(Mar 1974). (In Russian).

Data are presented on the distribution of ion concentration and the total activity of short-lived products of radon decay over the territory of Georgia. It is shown that in the free atmosphere the course of the concentration of light ions is opposite to the course of the daughter products of radon decay. (auth)

9533 FORMATION OF RADIOACTIVE EUROPIUM ISOTOPES IN NUCLEAR EXPLOSIONS. Iokhel'son, S. V.; Nazarov, I. M.; Rovinskii, F. Ya.; Chirkov, V. P.; Yushkan, E. I. pp 42-45 of Yadernaya Meteorologiya. Makhon'ko, K. P. (Ed.). Moscow; Moskovskoe Otdelenie Gidrometeoizdata (1971). (In Russian).

Various europium isotopes are formed in nuclear explosions: the fission products ^{155}Eu ($T_{\frac{1}{2}}$ = 1.7 y) and ^{156}Eu $T_{\frac{1}{2}}$ = 15.4 d) and the activation products ^{152}Eu ($T_{\frac{1}{2}}$ = 12 y) and ^{154}Eu ($T_{\frac{1}{2}}$ = 16 y). These have been observed in the epicentral zone of nuclear explosions in Nevada (USA) but not in the global radioactive contamination of the Earth's surface. To determine the contribution of long-lived Eu radioisotopes to the total contamination, by radiochemistry and gamma spectrometry, samples from a lake in Kansas were analyzed by radiochemistry and gamma spectrometry. Along with other fission products, ^{155}Eu was identified, but ^{152}Eu and ^{154}Eu were shown to be absent. From these results the total ^{155}Eu dry-land contamination and its contribution to the gamma dose rate were estimated. (tr-auth)

9534 DATA. Section IV. Other Data. Radiat. Data Rep.; 15: No. 4, 203-225(Apr 1974).

Environmental radiation monitoring data obtained at the Hanford Atomic Products Operation for the period January to December 1970 are presented. (LK)

Atmosphere

Refer also to abstracts 9107 and 9495.

9535 (BARC/I-243) HEALTH PHYSICS SURVEY OF NARWA PAHAR URANIUM MINE. Iyengar, M. A. R.; Raghavayya, M.; Saha, S. C.; Markose, P. M.; Jha, G.; Khan, A. H.; Ghosh, D. K.; Srivastava, G. K.; Eappen, K. P. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 35p. INIS.

The present mining activities at the Narwa Pahar site (India) of the uranium mines and the health hazards associated with uranium mining are described in brief. A total of 10 surveys dealing with radiological, environmental, and industrial hygiene aspects of the mines were conducted during the period from 1966 to 1972. The findings of these surveys are analyzed and summarized. Based on them, recommendations have been made to control the hazards and to safeguard the health and safety of the miners and the population at large. (INIS)

9536 (CONF-740212-3) MEASUREMENT OF RADON PROGENY CONCENTRATIONS IN AIR BY ALPHA-PARTICLE SPECTROMETRY. Kerr, G. D. (Oak Ridge National Lab., Tenn. (USA)). 1974. 10p. Dep. NTIS $4.00.

From 2nd environmental radiation workshop; New York, New York, USA (20 Feb 1974).

Short-lived radon progeny attached to dust particles in the air can be measured by taking three counts of alpha-particle activity collected on a filter with an air sampling device. The technique is described in detail. (LK)

9537 (INIS-mf-887-1, pp 146-152) METHODS OF CONTROLLING THE CONTENT OF LOW-ENERGY BETA NUCLIDES IN ENVIRONMENT. Chudy, M.; Povinec, P.; Saro, S.; Seliga, M. (Komenskeho Univerzita, Bratislava, Czech). [nd]. (In Slovak).

Methods are described of measuring the concentration of ^{3}H and ^{14}C in the atmosphere. Samples were obtained by the separation of water vapors and CO_2 on a molecular sieve. Also, a sampling device was used with an absorbing solution of barium hydroxide. CO_2 samples were analyzed using CO_2- and CH_4-filled proportional counters. ^{3}H concentration was determined by a methane-filled proportional counter or a liquid scintillation counter with a dioxane scintillator. The properties are compared of proportional counters and of scintillation counters in measuring low activities of ^{3}H and ^{14}C. (INIS)

9538 (PB-188691) EVALUATION OF RADON 222 NEAR URANIUM TAILINGS PILES. (Bureau of Radiological Health, Rockville, Md. (USA)). Mar 1969. 67p.

A project was begun in June 1967 to evaluate the public health aspects of atmospheric concentrations of ^{222}Rn in the vicinity of uranium tailings piles. The four sites investigated were Grand Junction, Colo., Durango, Colo., Monticello, Utah, and Salt Lake City, Utah. As a result of the project, a technique for taking integrated air samples for radon near uranium tailing piles was developed, tested and proven through field use. The measurements indicated no significant radiation exposure to the public from this source. No conclusive evidence was obtained to verify the theory that stabilization and covering of uranium tailings piles would reduce the emanation of Rn from the piles. It was concluded that no recommendations to control public exposure to radon from uranium tailings piles is necessary since no significant public exposure was found. (LCL)

9539 (SCPRI(RM)-11-1973) REPORT OF ACTIVITY, NOVEMBER 1973. (Service Central de Protection Contre les Rayonnements Ionisants, 78-Le Vesinet (France)). 1973. 15p. (In French). Dep. NTIS (US Sales Only) $4.00.

This monthly report of the SCPRI exposes an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts (air at ground level, high altitude air), rainwater, surface water, underground water, irrigation water, drinking water, food chain (milk, plants, cattle, fish), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A monthly bibliographic selection is also presented. (FR)

9540 (SCPRI(RM)-11-1973(Suppl.)) ANNEX TO MONTHLY REPORT, NOVEMBER 1973. Detail of Results of Measurement. (Service Central de Protection Contre Les Rayonnements Ionisants, 78 - Le Vesinet (France)). 1973. 22p. (In French). Dep. NTIS (U. S. Sales Only) $4.25.

Measurement tables concerning the surveillance of the environment (see also the SCPRI-RM-11-1973 report). (FR)

9541 EVALUATION OF THE APPLICABILITY OF SOME METHODS FOR THE MEASUREMENT OF THE SHORT LIVED DECAY PRODUCTS OF ^{222}Rn BY MEANS OF A NEW α-SPECTROMETRIC EXTRAPOLATION METHOD. Uzunov, I.; Gumnerova, L.; Kritidis, P.; Minev, L.; Apostolova, M. God. Sofii. Univ., Fiz. Fak.; 65: 425-442(1970). (In Bulgarian).

In order to evaluate the accuracy and applicability of the method originally developed by Tsivoglou et al, and some of its modifications, a new α-spectrometric extrapolation method is described and applied as a base for comparison. By means of suitable laboratory experiments, measurements in radon spa's and the use of more than hundred theoretically computed curves, it is shown that the accuracy of most of the compared methods is not sufficient, especially when the absorbed dose is calculated by means of the method of Haque and Collinson. Only one of the discussed modifications, developed previously by the authors, shows an acceptable accuracy, but in spite of this it is suggested, that suitable two-channel portable spectrometers with Si—surface barrier detectors have to be developed and used in the future for routine measurements. (auth)

9542 DATA. Section III. Air and Deposition. Radiat. Data Rep.; 15: No. 4, 194-202(Apr 1974).

November 1973 measurements of the gross β-activity in surface air and precipitation at 24 sampling stations in Canada and 14 stations in the US and for the gross β-activity in surface air only at 49 US, 12 Pan American, and 14 California sampling stations are presented. (LK)

Soil

9543 (COO-1495-24) MOVEMENT OF STRONTIUM THROUGH THE SOIL TO THE PLANT ROOT MEMBRANE. Progress Report, September 1, 1973-August 31, 1974. Barber, S. A.; Malzer, G. L. (Purdue Univ., Lafayette, Ind. (USA)). 1974. Contract AT(11-1)-1495. 33p. Dep. NTIS $4.75.

Distribution of Ca and Sr among the several phases of the soil and the influence of this distribution on the rate of supply of these ions to, and absorption by the root were investigated. Calcium and Sr in the soil may be present as soluble ions, soluble chelates, exchangeable cations, and precipitates. Adding a soluble chelate to the soil system either decreases or increases the Ca/Sr ratio in solution depending on the nature of the chelate. When $CaSO_4$ or $SrSO_4$ precipitated about the root, the uptake rate of the precipitating ion was reduced relative to the non-precipitating cation. Uptake of Ca and Sr from soluble chelates in solution was greater than direct absorption of the chelate indicating that cat-

ion exchange between the root and the chelate probably occurred. The Cd-electrode was used in developing a procedure to measure potentiometrically the amount of chelate in solution. A procedure was also developed to measure on one plant system Ca and Sr uptake rate over a wide range of their concentrations in solution. Translocation of Ca and Sr was related to the Ca/Sr ratio in the external solution rather than the Ca/Sr ratio in the plant root. (auth)

9544 (LA-5579-PR) CONTAMINATION LIMITS FOR REAL AND PERSONAL PROPERTY. Progress Report, July–December 1973. Healy, J. W.; Smith, W. J. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1974. Contract W-7405-eng-36. 6p. Dep. NTIS $4.00.

A summary of the work performed during this period along with some needed programs to obtain additional data is given. A brief description of the preliminary standard for plutonium in soils along with progress on a calculation of the FIDLER calibration and a conceptual model for contamination transfer from an object to the body is included. (auth)

9545 MIGRATION OF ^{60}Co IN LOOSE ROCKS CONTAMINATED WITH EFFLUENTS FROM AN ATOMIC ELECTRIC POWER STATION (AES). Orlova, E. I.; Smirennaya, V. A. Chelysheva, R. A. Gig. Sanit.; No. 3, 50-53(Mar 1974). (In Russian).

In nontechnological effluents with detergents ^{60}Co changes into a chemical state that is not sorbed by rocks. The finding is that it is due to formation of negatively charged combinations of cobalt with trilon B. In order to diminish the migrating properties of ^{60}Co it is suggested to exclude trilon B from detergents used at AES. (auth)

Water

9546 (COO-3180-12) RADIOISOTOPES AND OCEANIC MIXING. Technical Progress Report. Broecker, W. S. (Columbia Univ., Palisades, N. Y. (USA). Lamont-Doherty Geological Observatory). May 1974. Contract AT(11-1)-3180. 60p. Dep. NTIS $6.00.

Progress in reducing and interpreting data collected during the Atlantic and Pacific GEOSECS expeditions is reported. The main effort is directed toward understanding the mixing processes taking place in the lower 1 km of the water column. Plots are presented of ^{222}Rn content versus distance above the ocean floor. (LCL)

9547 (DPSP-56-25-13(Del.)) REGIONAL MONITORING GROUP, HEALTH PHYSICS SECTION SEMIANNUAL PROGRESS REPORT, JANUARY–JUNE 1955. Alexander, J. M.; Horton, J. H. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Atomic Energy Div.). 5 Apr 1956. 41p. Dep. NTIS $5.25.

The deposition of 1×10^{-7} c/ft^2 (curies per square foot) of beta activity in this area due to bomb fallout between February and the end of June obscured radioactivity release due to plant operations. As a result, all types of samples collected contained unusually high quantities of beta activity. These samples included vegetation, stream water and mud, air filters, radioactive particles collected with flypaper, public water, and rainwater. Also, the increased atmospheric radiation was detected with detachable ionization chambers. Because of uranium waste from the 300 Area, Tims Branch continued to contain the highest concentrations of radioactivity in stream water and mud. None of the other streams was entirely free of radioactive contamination due to plant operations, but the concentrations were negligible. Concentrations of radioactivity in seepage basins continued to fluctuate widely. The 100-R and 100-P Areas had atmospheric radiation dosage rates slightly higher than did other areas. Otherwise, there was no detected local contamination due to airborne radioactive plant waste. (auth)

9548 (IAEA-R-757-F) 1. STUDY OF RADIONUCLIDE UPTAKE BY MARINE ORGANISMS IN AN ARTIFICIAL POOL AND ELIMINATION OF RADIOACTIVITY UNDER NATURAL CONDITIONS. 2. BEHAVIOUR OF RADIOISOTOPES CONCENTRATED IN THE SURFACE LAYER SEDIMENTS UNDER QUASI-NATURAL CONDITIONS. Final Report, 1 July 1969–31 December 1971. Ros, J.; Costa, F. (International Atomic Energy Agency, Vienna (Austria)). Dec 1972. 20p. INIS.

The distribution of zinc-65 was followed over a period of 209 days in seawater, sediments (clay and sand), and marine organisms (phytoplankton, fish, shellfish, and shrimp) in an artificial pond of 6 m^3 volume containing zinc-65 contaminated water. At the start of the experiment almost half of the activity was adsorbed by the wall of the pond, while the other half was mainly accumulated by the organisms and partly by the sediments. Later on the activity was mainly found in the sediments. The chemical forms of zinc-65 sorbed by the sediments was investigated by applying conventional methods used in soil-science to the sediments. These methods are capable of determining the fractions that are utilizable for plants. It was found that only at the start of the experiment the percentage of utilizable zinc-65 was about 30% of the total sorbed zinc-65, decreasing later to below 1%. Diffusion of zinc-65 into the sediment was very slow in clay and was absent in sand. In the clay this diffusion was considered to be due to biological activity of organisms present in the clay. (INIS)

9549 (INIS-mf-887-3, pp 113-123) VARIOUS CAUSES OF DIFFERENCES BETWEEN ACCUMULATION COEFFICIENTS OF ^{137}Cs AND OF STABLE Cs IN FRESHWATER ORGANISMS UNDER NATURAL CONDITIONS. Flaishman, D. G.; Kanevskii, Yu. P.; Solyus, A. A. (AN, SSSR, Leningrad). [nd]. (In Russian).

The migration and distribution of ^{137}Cs in the ecosystem of a lake was clarified by investigating the content of ^{137}Cs and stable Cs in the water, the sediments, and in the water organisms. It was determined that nuclear explosions led to an increase in ^{137}Cs concentration, followed by a decrease related to the washing out of the radionuclide and to its being deposited in the sediments as a result of the process of absorption and detritus formation. In freshwater organisms receiving all or part of their Cs from the sediments, the coefficient of ^{137}Cs accumulation will be lower than that of stable Cs. The decrease in ^{137}Cs concentration in the water of the lake is accompanied by a decrease in the specific activity of Cs to the level of active layers. Freshwater organisms receiving Cs from these layers will have a coefficient of ^{137}Cs accumulation higher than the coefficient of stable Cs accumulation. (tr-auth)

9550 (PB-178728) RADIOLOGICAL SURVEY OF MAJOR CALIFORNIA NUCLEAR PORTS, APRIL 1967. Cahill, D. F.; McCurry, D. C.; Breakfield, W. D. (Southeastern Radiological Health Lab., Montgomery, Ala. (USA)). 8 Apr 1968. 29p.

The nuclear port surveillance program of the Southeastern Radiological Health Laboratory conducted in conjunction with the Naval Ship Systems Command, U. S. Navy, was extended to the major nuclear ports on the west coast of the United States at San Diego and the Mare Island Naval Shipyard. These ports, which are located in or proximal to the metropolitan areas of San Diego and San Francisco, California, contain berthing, maintenance and/or construction facilities for nuclear powered submarines. Radiological surveys were conducted at San Diego Bay and its environs from April 3 to 7, and at the Mare Island Naval Shipyard and environs from April 10 to 13, 1967. The objectives of the surveys were the location, identification, and quantification of radionuclides, and the assessment of the possible public health implications of nuclear vessel operation in these areas. Results showed that low levels of ^{60}Co γ activity were restricted to a small area of San Diego harbor. The slight dispersion of low activities and the absence of activity in environmental samples other than sediment indicate that the operation of nuclear powered submarines in this area under present conditions poses no public health problem. The absence of ^{60}Co activity in the Mare Island Strait and samples of environmental materials indicated there is no public health hazard from the variety of nuclear operations at the shipyard. (CH)

9551 (SFL-A-19) NATURAL RADIOACTIVITY OF GROUND WATER IN THE HELSINKI AREA. Kahlos, H.; Asikainen, M. (Institute of Radiation Physics, Helsinki (Finland)). Nov 1973. 59p. Dep. NTIS (US Sales Only) $6.00.

A study of the natural radioactivity in ground water was performed in the Helsinki area. The survey indicated highly radioactive water in some bored wells. Nuclides originating from the uranium and thorium series were investigated, and ^{222}Rn, ^{226}Ra, ^{228}Ra and U_{nat} were detected. The concentrations of the nuclides were determined with radiochemical analyses or with gamma spectrometric measurements. The methods of analysis are described, locations and use of the wells are presented, and the results reported in detail. The highest concentrations found were for ^{222}Rn 309 nCi/l, for ^{226}Ra 256 pCi/l, for ^{228}Ra 5.6 pCi/l and for U_{nat} 14.9 mg/l. The ^{210}Pb/^{222}Rn and ^{234}U/^{238}U ratios in some waters were determined. Anomalous ^{234}U/^{238}U ratios were found in samples. The influence of the concentrations on the long-term users was considered from the point of view of radiation protection. Natural radioactivity of ground water in the Helsinki area was also compared with the results presented in the literature. (auth)

9552 DATA. Section II. Water. Radiat. Data Rep.; 15: No. 4, 191-193(Apr 1974).

Data from radiation monitoring during 1970 of surface, ground, and drinking waters sampled in Florida are reported. (LK)

Ecosystems and Food Cycles

Refer also to abstracts 10033, 12129, 12130, and 12132.

9553 (INIS-mf-887-2, pp 43-50) DETERMINATION OF RADIOACTIVE CONTAMINATION OF VEGETABLE PRODUCTS AND METHOD OF ACTIVITY MEASUREMENT. Liszonyi; Kiss, B.; Kovacs, J. (Fovarosi Elelmiszerellenorzo es Vegyvizsgalo Intezet, Budapest). [nd]. (In Hungarian).

The results are tabulated of measuring the radioactive contamination of spinach, sorrel, and lettuce in the period 1960 to 1971. Measurements were carried out in the spring and in the autumn of each year. Sample preparation for the measurement and the method of activity measuring are described. (INIS)

9554 (INIS-mf-887-2, pp 72-76) DETERMINATION OF RADIOACTIVE CONTAMINATION OF ANIMAL PRODUCTS AND METHODICAL PROBLEMS INVOLVED. Kiss, B.; Kovacs, J.; Liszonyi; Gacsalyi, M. (Fovarosi Elelmiszerellenorzo es Vegyvizsgalo Intezet, Budapest). [nd]. (In Hungarian).

The measurement is briefly discussed of radioactive contamination of the bones of cattle, of milk, fish, and of various internal organs of swine. A Geiger-Mueller detector was used in the measurement. (INIS)

9555 (INIS-mf-1042) EVALUATION OF THE INTERNAL POPULATION DOSE FROM GLOBAL CESIUM-137 IN A NUMBER OF NATIONALITIES OF THE FAR NORTH OF THE SOVIET UNION. Ushakova, A. P.; Likhtarev, I. A.; Moiseev, A. A.; Ramzaev, P. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1973. 8p. (In Russian). INIS.

The purpose of the study was to estimate the internal population dose from global cesium-137 for a relatively sparse population living in the Far North of the USSR. The cumulative amount of cesium-137 taken in with the diet determines the population dose. It was established that the cumulative amount of cesium taken in with the diet by various core population groups varies a great deal depending on a number of factors as the diet composition and the average content of cesium-137 in venison, that is, the expected dose depends not on demographic but on ecological factors. (SJR).

9556 (INIS-mf-1266) RADIOCOBALT MEASUREMENTS IN THE ENVIRONMENT OF TARAPUR ATOMIC POWER STATION. Iyer, R. S.; Chandramouli, S.; Bhat, I. S. (Tarapur Atomic Power Station (India)). 1972. 8p. INIS.

From symposium on environmental pollution; Bombay, India (28 Oct 1972).

Radiocobalt is an important pollutant in the environmental release of liquid radioactive waste from nuclear power reactors. ^{60}Co with 5.27 years half-life and ^{58}Co with 72 days half-life are the important cobalt radioisotopes produced by the activation of structural materials of the nuclear reactors. Tarapur Atomic Power Station (TAPS), with two BWR units of 400 Mwe total capacity, has been discharging small amounts of radiocobalt to the marine environment after dilution with condenser coolant. In the marine environment, radiocobalt gets absorbed in the silt and the bottom dwelling and feeding marine organisms; algae concentrate the radiocobalt from the sea water and silt. In the marine food chain uptake it can reach people by ingestion of sea food. The present paper gives the details of the radiocobalt levels observed in the coastal marine algae and sea food samples collected from the environment of the TAPS site from 1969 to 1972. It has been observed that Onchidium and certain species of marine algae with highest concentration of ^{60}Co can be used as indicators of radiocobalt marine contamination at Tarapur. (auth)

9557 (VUZV-1) RADIOCESIUM ELIMINATION IN THE CHAIN PLANT PRODUCTS–ANIMAL PRODUCTS. Dvorak, P.; Krupkova, B.; Hauner, T.; Olsova, M. (Ceska Akademie Zemedelska, Uhrineves (Czechoslovakia). Vyzkumny Ustav Zivocisne Vyroby). 1972. 103p. (In Czech). INIS.

Experimental results are reviewed of radiocesium elimination in the chain plant products-animal products. A speedy decorporation of radiocesium in farm animals had been accorded primary importance. To enhance radiocesium decorporation, the effect of HCF (hexacyanoferrates) of heavy metals was employed. The optimum properties of the heavy metals were investigated. The results confirmed the assumption that the HCF of heavy metals were substances in whose structure an equilibrium amount of an alkali metal and hydrogen (mixed HCF of heavy metals), or an equilibrium amount of hydrogen (unmixed HCF of heavy metals), is incorporated, capable of the equilibrium substitution for univalent cations having more favorable ionic radii. A comprehensive literary review is supplemented. (INIS)

9558 FALLOUT STRONTIUM-90 AND CESIUM-137 IN NORTHERN ALASKAN ECOSYSTEMS DURING 1959–1970. Hanson, W. C. Fort Collins, CO; Colorado State Univ. (1973). 259p. University Microfilms Order No. 73-29,039.

Thesis (Ph. D.).

Cycling routes, rates of transport, and resultant concentrations of the fallout radionuclides ^{90}Sr and ^{137}Cs in northern Alaskan ecosystems were defined during the period 1959 to 1970. Radiochemical analysis of extensive samples of biota and whole-body counting of ^{137}Cs in Eskimo and Indian ethnic groups were related to ecological principles, especially the concept of trophic niche, which elucidated the observed patterns of radionuclide concentrations. Experiments involving strontium and cesium radioisotopes applied to natural Cladonia-Cetraria lichen carpets yielded effective half-times of 1.0 to 1.6 years for strontium and more than 10 years for cesium. Direct and indirect estimates of ^{137}Cs half-times in Eskimos on a caribou meat diet were made by dietary manipulation and by relating dietary ^{137}Cs intake and resultant change between periodic whole body counts. Effective half-times of 70 days for adults (more than 21 years old) and minors (14 to 20 years old) and of 45 days for children (less than 14 years old) were found. ^{137}Cs concentrations measured in 9 lichen species collected at 20 sampling sites across the 389,000 km^2 study area showed significant differences between physiogeographic provinces, with highest amounts in those samples from areas of highest annual precipitation. Similar geographic differences were found in comparison of caribou flesh from Alaskan herds; greatest amounts occurred in southern herds and least amounts in Arctic herd animals. ^{137}Cs body burdens of native ethnic groups were correlated with their dependence upon caribou meat for the food base; highest amounts were consistently measured in Anaktuvuk Pass Eskimos, median amounts in river village Eskimos and interior Athapascan Indians, and lowest amounts occurred in coastal Eskimos who utilized marine mammals and other food sources. Suitable mathematical models were used to compute lichen forage ingestion rates of free-ranging adult caribou (4.5 to 5.0 kg dry weight per day), caribou meat ingestion rates of Anaktuvuk Pass residents (up to 2 kg wet weight per day for men), and ^{90}Sr body burdens of Anaktuvuk Pass residents during the period 1952 to 1968 (maximum value of 8 nCi in adult males during late 1966–early 1967). Special emphasis was made of cultural influences upon the food-gathering patterns of the native peoples studied. Culture change, especially in the form of food stamps, welfare payments, acquisition of snowmobiles, and "improved" housing was documented throughout the study and noticeably reduced the radionuclide accumulations. Total radiation dose rates to the Anaktuvuk Pass adult population were estimated to be about 100 mrad/year from natural sources, 60 to 140 mrad/year from ^{137}Cs body burdens, and 20 to 130 mrad/year from ^{90}Sr body burdens. (Diss. Abstr. Int., B)

9559 TOTAL ALPHA ACTIVITY DETERMINATION IN FOODSTUFFS. Frindik, O. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). Deut. Lebensm.-Rundsch.; 69: No. 10, 364-368(Oct 1973). (In German).

The total alpha activity of foodstuffs was determined from the activity of the ashes. In individual foodstuffs and in complete daily rations an alpha activity of 5 to 6 pCi/kg was found. Ashed soil samples from the Rhine valley near Karlsruhe on the average gave higher activities by a factor of 21 than ashes of food from the same region. No increase of alpha activity was found in biological samples near nuclear installations. (GE)

9560 DATA. Section I. Milk and Food. Radiat. Data Rep.; 15: No. 4, 181-190(Apr 1974).

Data are reported on the ^{137}Cs and ^{90}Sr content in milk at 63 sampling stations in the US, 16 stations in Canada, and 7 stations in Central and South America for November 1973 and for the 12-month period from December 1972 to November 1973. (LK)

Radiometric Techniques

Refer also to abstracts 9225, 9488, 9644, 9647, and 12056.

9561 (COO-1515-54) EOLIAN ADDITIONS TO SOIL. (Jackson, M. L. (Wisconsin Univ., Madison (USA). Dept. of Soil Science). 1974. 13p. Dep. NTIS $4.00.

The depositional mixing processes which account for the distribution of quartz oxygen isotope ratio variations in major soil and sediment areas of the world are examined. (CH)

9562 (IAEA-R-514-F) STUDY OF THE DISTRIBUTION OF ACTIVE ROOTS IN ORANGE TREES USING P-32. Part of a Coordinated Programme on the Use of Isotopes to Study the Efficient Use of Fertilizers in Tree Culture. Final Report, 1 April 1967–31 July 1971. Mellado, L. (International Atomic Energy Agency, Vienna (Austria)). Sep 1972. 13p. (In Spanish). INIS.

Using a ^{32}P soil injection technique, the patterns of root activity of young and mature orange trees were studied in order to determine the best zones for fertilizer application. The ^{32}P content of young leaves sampled from the middle of the tree was used as a measure of root activity. The experiments were done on naval orange grafted to bitter orange planted at a spacing of 7 meter × 7 meter and grown under irrigation on two calcareous soil types—a fine sandy clay loam, and a coarse sandy clay loam. Young orange trees were observed to have high root activity at 1 to 2 meter distance and 30 cm depth. The mature 30 year old trees consistently showed highest activity at 3 meter distance and 30 cm depth. Root activity was also high at 2 meter distance and 30 cm depth. Both young and mature trees showed very little root activity below 30 cm depth at all distances tested (0.5 to 3 meters). Activity was generally low at 0.5 cm distance. Patterns of root activity were similar in both soil types on which the experiments were done. The results of these experiments have shown that young orange trees grown under the conditions described above should be fertilized at a distance of 1 to 2 meters from the tree and depth of 0 to 30 cms. In the case of mature trees, fertilizers should be applied at a distance of 2 to 3 meters from the tree. Under the light textured soil conditions, soluble nitrogeneous and potassic fertilizers can be applied on the surface, even though root activity was found to be highest at 30 cm depth. However, phosphatic fertilizers should be placed deep at 15 to 30 cms for maximum efficiency of utilization. (INIS)

9563 (KFK-1918) EXPERIMENTS CONDUCTED AT THE KARLSRUHE NUCLEAR RESEARCH CENTER TO DETERMINE DIFFUSION IN THE ATMOSPHERE BY MEANS OF VARIOUS TRACERS. Koenig, L. A.; Nester, K.; Schuettelkopf, H.; Winter, M. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Strahlenschutz und Sicherheit). Nov 1973. 32p. (In German). (CONF-731110-8). Dep. NTIS (US Sales Only) $4.75.

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973).

Experiments on atmospheric diffusion are reported which are currently performed at the Karlsruhe Nuclear Research Center. The objective of these experiments consists in verifying experimentally the diffusion calculations required for safety considerations. Tritiated water vapor and carbon tetrachloride were used as tracers. They were simultaneously mixed to the exhaust air from a 100-m-high reactor stack. A description is given of the sampling and measuring technique. The parameters describing the diffusion behavior of the tracers are assessed from the measured results through graphic and computational evaluations. The experimentally determined parameters were compared to the respective Pasquill–Gifford parameters. The significant result of this comparison is the shifting towards the source of the position of the radial concentration maximum as well as the increase in amount of this maximum relative to the values anticipated on the basis of the diagnosed Pasquill diffusion categories. (auth)

9564 COMPARISON OF RADIOACTIVE GLASSES OF SCANDIUM AND IRIDIUM AS TRACERS IN SEDIMENT-TRANSPORT STUDIES. Krishnamurthy, K.; Rao, S. M. (Bhabha Atomic Research Center, Bombay). J. Hydrol.; 19: No. 3, 189-204 (Jul 1973).

A systematic comparison was attempted of all important criteria for the selection of either scandium-46 or iridium-192 as the radioisotopic glass tracer for bed-load transport studies in rivers and estuaries. This study was restricted to only these two tracers as they are found to be the only strong contenders for quantitative long-range studies. The discussion led to the conclusion that, except for the transport problem, scandium-46 is preferable to iridium-192 in all other respects. (INIS)

Site Surveys

Refer also to abstract 9772.

9565 (DUN-2349) BEN FRANKLIN DAM STUDY. Final Report, I. Ballowe, J. W. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 17 Apr 1967. Contract AT(45-1)-1857. 61p. Dep. NTIS $6.25.

Declassified 6 Sep 1973.

Effects of the proposed Ben Franklin Dam on 100 Area facilities were studied for two reservoir elevations - 385 and 400 ft msl. The river flow consideration ranged from 36,000 to 450,000 cfps for both pool cases. The study activity principally consisted of three major programs directed at evaluating the general dispersion characteristic of the reactor effluent plumes under reservoir conditions and possible effect on plant inlet water temperatures, determining whether or not the discharge recirculates into adjacent river pumphouse intakes, and investigating the effect of an elevated groundwater table on 100 Area facilities and structures. Studies conducted in regard to steady-state reservoir effects resulted in the conclusion that no reservoir conditions would be created from the operation of Ben Franklin Dam at either reservoir elevation which would be adverse to 100 Area facilities and their operation; as noted, effects associated with transient reservoir operation have not yet been studied. Soil stabilization studies conducted to determine the effect of elevated groundwater tables on 100 Area facilities resulted in the following conclusions: No significant effect of the 385-ft or 400-ft reservoir would be expected on facility foundations, however, at 100-F and H Areas, where the predicted rise in water table will extend to or above some of the footings, it appears prudent to provide for monitoring settlements. The major effects of the elevated groundwater table are associated with the radioactive material burial grounds in 100-F and H Areas, and the proposed waste management emergency crib in 100-N Area. The present stage of the Ben Franklin Dam study program, it is considered that removal of critical buried wastes may be necessary, and an alternate concept or modified design for the 100-N waste disposal system appears to be required. Provisions for this corrective action are included in the cost estimates, with a final decision as to its necessity being reserved until a later stage. The estimated corrective cost estimate for the 385-foot msl reservoir is $2,500,000, and $3,800,000 for the 400-ft. reservoir with the 400-ft msl reservoir, some galleries and basins in the 105-H and F Buildings (reactors) may require protection against hydrostatic uplift. The effluent retention basins in both 100-F and H Areas may require additional protection from hydrostatic uplift. (LCL)

9566 (WASH-1301) CLASSIFICATION, ENGINEERING PROPERTIES, AND FIELD EXPLORATION OF SOILS, INTACT ROCK AND IN SITU ROCK MASSES. Hall, W. J.; Newmark, N. M.; Hendron, A. J. Jr. (Newmark (Nathan M.) Consulting Engineering Services, Urbana, Ill. (USA)). May 1974. Contract AT(49-5)-2667. 263p. Dep. NTIS $7.60.

The subsurface conditions at reactor sites must be thoroughly investigated in order to assure that the large, complex structures can be safely supported and will be subjected to minimum seismic effects. Detailed information is presented on: field identification of soils; grain and aggregate properties and seismic data related to soils; engineering properties of soils, rock, and in-situ rock masses; structural features of rock masses; soil and rock classification; state of stress in in-situ rock; and recommendations for conducting geophysical exploration and for evaluating the data obtained. (LCL)

Thermal Effluents

Refer also to abstract 9500.

9567 (COO-2160-9) INVESTIGATION OF THE INFLUENCE OF THERMAL DISCHARGE FROM A LARGE ELECTRIC POWER STATION ON THE BIOLOGY AND NEARSHORE CIRCULATION OF LAKE MICHIGAN. Part A. Biology. Final Report, 1 August 1971–31 July 1973. Beeton, A. M.; Barker, J. M. (Wisconsin Univ., Milwaukee (USA). Center for Great Lakes Studies). 1973. Contract AT(11-1)-2160. 141p. Dep. NTIS $10.25.

This study was undertaken to determine the environmental effects on Lake Michigan of a long-existent thermal discharge from the Oak Creek Power Plant (1760 MW) of the Wisconsin Electric Power Company. Monthly sampling for temperature, chemicals, zooplankton, and phytoplankton was conducted near the plant and in a reference area. Cluster and factor analyses of plankton data indicate the thermal discharge had little effect on plankton distribution. Differences between inshore and offshore stations were much greater than differences between study areas. The primary variable was distance from shore. Analyses of chemical data did not produce any useful relationships and none were related to those established for plankton. Results of two extensive synoptic and four near-plant surveys showed that water quality in the vicinity of the plant was a consequence of outflow from Milwaukee Harbor, sewage outfalls, and other point sources. These discharges resulted in high concentrations of chemicals nearshore, e.g., phosphorus was as much as 30 times greater nearshore than previously reported for the open lake. The power plant had no obvious influence on water quality or chlorophyll a distributions. Uptake of C-14 was measured in intake and discharge water of the power plant and various dilutions of the two to simulate effect of entrainment, i.e., the difference in uptake rates between discharge and intake samples, resulted in a 64% increase in uptake. Increased temperatures and mechanical stress resulted in 24% and 9% increases in uptake. (auth)

9568 (ORNL-tr-2766) ZOOPLANKTON OF MOSHKOVICH BAY, WHICH IS HEATED BY WASTE WATERS FROM THE KONA-

KOVSKI POWER STATION. Riv'er, I. K.; Gets, N. A. Translated by Martha Gerrard from Biol. Vnutr. Vod Inform. Byull.; No. 12, 4-8(1971). 8p. Dep. NTIS $3.00.

The study of the zooplankton of Moshkovich Bay was started in 1967 and continued throughout 1968 and 1969. Material was collected from the bay itself and also from surrounding areas that were not subjected to the effects of the heated waters released from the Konakovski power plant. The purpose of the studies was to find out something about changes in the species that make up the zooplankton of the bay, the ratios of the individual species, and characteristics of seasonal dynamics of the principal types. Data are included on the composition of zooplankton communities, biomass, and seasonal dynamics in response to water temperature. (CH)

9569 (ORNL-tr-2767) EFFECT OF CONSTRUCTION OF THE KONAKOVSKI POWER STATION ON THE PLANT LIFE IN MOSHKOVICH BAY. Zhukova, G. A.; Lisitsina, L. I. Translated from Biol. Vnutr. Vod Inform. Byull.; No. 12, 18-22(1971). 4p. Dep. NTIS $3.00.

The dispersion of the flora of Moshkovich Bay changed when the Konakovski power plant was built. When the canal was constructed and the river bed was deepened, ground work was done which interfered with and in some places even destroyed the existing flora. In addition, the mineral soils deposited on most of the shallow water regions had some checking effect on the shallow water swamps and the normal course of the succession. The effect of hot water on plant life is shown by the displacement of the vegetative phase of most plants by an average of about a month. In Moshkovich Bay, all species start to grow considerably earlier than in other parts of the water reservoir area. At the end of May and beginning of June, most of the plants are in flower, while in other sections they have only started to grow. The organisms that start to grow first are those in the deeper parts, close to the heated current, while under normal conditions the first plants to develop are those in the shallow water. (auth)

9570 POTENTIAL EFFECTS OF THERMAL DISCHARGES ON AQUATIC SYSTEMS. Bush, R. M.; Welch, E. B.; Mar, B. W. (Univ. of Washington, Seattle). Environ. Sci. Technol.; 8: No. 6, 561-568(Jun 1974).

Ecological changes in the aquatic environment caused by temperature increase are estimated in order to aid the decision process in siting cooling water discharges. Principal consideration is given to the fish community for which predictions of change in composition are based on lethal and preferred temperature. Six representative river systems in the country are considered. Insufficient data precluded similar community response estimations for freshwater invertebrates. However, data indicate that adequate protection of fish species results in like protection of the invertebrate fauna and thus the estimated effect of elevated temperature on freshwater fish communities will suffice as a guideline for both the protection of fish and invertebrates. Similar predictions were not possible for the marine community since thermal requirements are known for only a few species. However existing data and site studies are summarized for use as guidelines. (auth)

9571 EFFECTS AND METHODS OF CONTROL OF THERMAL DISCHARGES. Report to the Congress by the Environmental Protection Agency in Accordance with Section 104(t) of the Federal Water Pollution Control Act Amendments of 1972. Part 2. Impact of Thermal Discharges on Air Quality, Effects of Thermal Discharges on Land Used, Methods of Control of Thermal Discharges Temperature Distribution Analysis, Thermal Aspects of Aquatic Chemistry, Ninety Third Congress, First Session, November 1973. Washington, DC; Senate Committee on Public Works (1973). 575p. GPO $3.70.

9572 PARAMETERS NECESSARY FOR ANALYZING THERMAL BIOASSAYS ON MARINE FISH. Smith, R. D. J. Sanit. Eng. Div., Amer. Soc. Civil Eng.; 98: No. SA6, 973-985(Dec 1972).

Increasing concern over effects of future thermal discharges to the Chesapeake Bay from nuclear power plants and other sources has led to studies of the associated response of indigenous species of fish. The white perch, Roccus americanus, whose economic significance in the bay is valued at $230,000 annually, was studied. For water temperatures ranging between 82°F (300.9°K) and 97°F (309.3°K), the lethal effects on a white perch being held at any temperature within that range will occur within the 1st 36 hr of exposure. This is shorter than the time period prescribed in general by the standard bioassay procedure. Three parameters are given which more completely describe the pattern of mortality. A relationship exists between the temperature at which mortalities of the white perch are incipient and the temperature at which the body of the fish is functioning. The lethal effects on white perch caused by extreme water temperatures are independent of the rate of temperature increase. (Oceanic Abstr.)

9573 EFFECTS OF HEATED EFFLUENTS FROM A NUCLEAR REACTOR ON SPECIES DIVERSITY, ABUNDANCE, REPRODUCTION, AND MOVEMENT OF FISH. Clugston, J. P. Athens, GA; Univ. of Georgia (1973). 121p. University Microfilms Order No. 74-4769.

Thesis (Ph. D.).

Evaluation was made of effects of heated effluents on fish communities in a series of cooling reservoirs at the U. S. Atomic Energy Commission's Savannah River Plant, Aiken, South Carolina. Research was conducted in a 76 hectare reservoir (Pond C) and a 1,120 hectare reservoir (Par Pond). Water temperatures in parts of the smaller reservoir sometimes exceeded 50°C. About 10 percent of the large reservoir's total surface area is altered thermally. The study was conducted between July 1969 and December 1972. The number of species found in the cooling reservoirs differed. Fourteen species were collected in Pond C and 27 species in Par Pond. Largemouth bass, bluegill, redbreast sunfish and mosquitofish were the only species found to reproduce within Pond C. Bluegill were found in water ranging from 35 to 41°C. Largemouth bass were common in water 32 to 35°C. The species composition and standing crop of the fishes in Par Pond were similar to nearby reservoirs in South Carolina. Mean standing crops found were 106 kg/ha in 1969 and 177 kg/ha in 1972. The standing crop found in the heated portion of Par Pond did not differ greatly from ambient waters in 1972. In 1969 the ambient coves contained 95.4 kg/ha and the heated cove 300.1 kg/ha. Fish kills were observed as a result of two different circumstances. A number of times fish were attracted by cool water and subsequently trapped away from refuge areas and killed by rising temperatures. One fish kill occurred when blueback herring migrated from water 16°C and swam into water 25°C. This study suggests that, if the water temperature is above the generally accepted spawning temperature of 20°C for bluegill over a certain period, spawning can occur during most months. Ripe females were collected every month of the year in Pond C. It appears that a period of increasing water temperature is required to stimulate reproductive behavior. Tracking of largemouth bass with temperature-sensing ultrasonic transmitters suggests there is a continuous rotation of bass into and out of the thermal mixing area in Par Pond and that there is not a discrete population that has been self-acclimated to the warmer water and forced to remain in the heated effluent. Bass in Pond C were able to seek-out cool refuge areas when water temperatures reached approximately 30°C. Evidence of water flow as important in attracting bass was found. Each fish tracked moved in a manner differently than other fish tagged at the same time and location. (Diss. Abstr.)

Chemical Effluents

Refer also to abstracts 9227, 9251, 9497, 9501, 9521, and 9527.

9574 (EPA-600-5-73-12-C) STUDIES IN ENVIRONMENT. Volume III. Pollution and Municipality. Cooper, P. C.; Kursh, S. J.; Wakeland, J. R.; Van Winkle, M.; Zoller, M. A. (Environmental Protection Agency, Washington, D. C. (USA)). Feb 1974. 108p. GPO.

Recent studies have focused attention on the fact that residents of inner-city neighborhoods are subject to greater amounts of pollutants than are other neighborhoods of large cities. The premise was investigated at the metropolitan scale, seeking to discover differences of impact between the center city and its suburbs. (CH)

9575 (ORNL-EIS-73-60(Vol.1)(No.5)) NSF-RANN TRACE CONTAMINANTS ABSTRACTS. Copenhaver, E. D. (ed.). (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W-7405-eng-26. 26p. Dep. NTIS $4.50.

Twenty-one abstracts of publications on the pollution of the environment by various chemical pollutants and trace metals are presented. Indexes of authors, keywords, and permuted titles are included. (LCL)

9576 COOLING WATER CHLORINATION AND PRODUCTIVITY OF ENTRAINED PHYTOPLANKTON. Carpenter, E. J.; Peck, B. B.; Anderson, S. J. (Woods Hole Oceanographic Institution, MA). Mar. Biol.; 16: No. 1, 37-40(Sep 1972).

The effects of various Cl concentrations on marine photoplankton productivity were studied at a nuclear power station on northeastern Long Island Sound. Chlorine concentrations considerably below levels required to eliminate fouling organisms in power station cooling systems (between 0.25 and 0.75 ppM residual at discharge)

produced large decreases in productivity of entrained phytoplankton. At the highest Cl concentration tested, 0.4 ppM residual at discharge, there was an 83% decrease in productivity compared with intake productivity. Productivity measurements were made at 6 other continuously applied Cl concentrations. At the lowest concentration tested (addition of 0.1 ppM Cl at intake), there was a production decrease of 79%. Intermittent Cl application produced slightly less decrease in primary productivity. There was essentially no effect on productivity with no Cl application. Chlorine cannot be used effectively as a biocide for fouling organisms without having adverse effects on entrained phytoplankton. (Oceanic Abstr.)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstract 11816.

General Detectors and Monitors

Refer also to abstracts 9473, 9793, 9794, 9850, 10072, 10082, 10083, 10126, 10137, 10529, 11483, and 11687.

9577 (COO-323-31) SPECIAL PROBLEMS IN NUCLEAR INSTRUMENTATION. Progress Report, June 1, 1973–May 31, 1974. Spokas, J. J. (Illinois Benedictine Coll., Lisle (USA). Physical Sciences Lab.). 1974. Contract AT(11-1)-323. 22p. Dep. NTIS $4.25.

Two new conducting tissue-equivalent plastic mixtures were successfully prepared. One mixture consists of 30 percent carbon and 70 percent polypropylene while the other consists of 20 percent carbon and 80 percent polypropylene. Several improvements in the design and fabrication of small 0.5 cc ionization chambers are reported, and experience with these chambers is reported. (auth)

9578 (IFA-HE-83-1973) IDENTIFICATION OF HEAVY IONS IN AgCl MONOCRYSTALS BY MEANS OF MULTIPLE COULOMB SCATTERING. Cincheza, I. M.; Friedlaender, E. M.; Haseganu, D. G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 14p. Dep. NTIS (U. S. Sales Only) $4.00.

The scattering constant of AgCl monocrystals was estimated by comparing the multiple Coulomb scattering of stopping ^{16}O ions as a function of residual range in an AgCl monocrystal and in Ilford G_5 nuclear emulsion. The ratio of scattering constants for the two media was found to be 1.255 ± 0.038, as compared to the theoretical prediction of 1.273. Absence of sizeable distortion in the monocrystal was checked by measurements on fast ^{16}O ion tracks. The reading noise level on the AgCl tracks was found to be at most equal to that in nuclear emulsion. From the observed dispersions it is estimated that a track length of 8 mm in the monocrystal should be sufficient to estimate the ion charge within one unit. (auth)

9579 (IFA-RS-2-1973) INPUT CIRCUIT FOR GAS DISCHARGE RADIATION DETECTORS. Draghicescu, M.; Iliescu, V. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 19p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

The counting characteristics, dead time, resolution time, and recovery time of halogen-filled gas discharge detectors were determined as a function of the input circuit selected. (JSR)

9580 (JINR-13-7013) STRUCTURE AND PERFORMANCE OF PROPORTIONAL CHAMBER WITH 600×300 mm^2 AREA. Birulev, V. K.; Grigalashvili, T. S.; Gus'kov, B. N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1973. 15p. (In Russian). INIS.

The design and the operating characteristics are given for a proportional chamber with an area of 600×300 mm^2. The recording electronics, a SAMAS model, are described. The apparatus was constructed at JINR. (tr-auth)

9581 (JINR-13-7101) CURRENT-FREQUENCY CONVERTER FOR IONIZATION CHAMBER. Zinov, V. G.; Krasnoborodov, B. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1973. 8p. (In Russian). INIS.

A current-frequency converter is described in which the charge accumulated on a measuring condenser is compensated by the current of exit pulses. The circuit allows for inclusion of a long cable between an ionization chamber and the electronic part of the instrument. Thus it is possible to use the converter for operation in high radiation fields. The current-frequency converter was developed at the Laboratory of Nuclear Problems. OIYaI. (SJR)

9582 (JUL-1012-RX-RW) INVESTIGATIONS ON THE DEVELOPMENT OF HIGH-TEMPERATURE ACTIVATION PROBES. Greiss, H. B.; Naoumidis, A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). Oct 1973. 26p. (In German). Dep. NTIS (US Sales Only) $4.50.

Investigations have been carried out on the development of activation probes for fluence measurements in high temperature reactor experiments in which the losses of the measuring nuclide are less than 1% even at temperatures above 1,200°C and exposure times of 200 days. Probe systems, consisting of a high-temperature stable alloy of the measuring nuclide with a highly soluble metal, enclosed in a capsule made of a material of very low solubility, have proved to be promising. The resulting low concentration of the measuring nuclide in this system in the inner peripheral layer of the capsule leads to a correspondingly low transport of material through the capsule wall. Out-of-pile experiments with this type of probe, consisting of (V-1% Co) alloy, welded in Al_2O_3 capsules, showed a maximum loss of cobalt of 6% at 1,400°C and annealing time of 104 days. Regarding the question of the chemical stability of the probes, experiments on the corrosion rate of Al_2O_3 and niobium through graphite have been carried out. The results showed that it is possible to keep the ceramic from chemical decomposition by enclosure in a niobium capsule. (GE)

9583 (KFTI-72-15) FABRICATION TECHNOLOGY AND PERFORMANCE OF Si(Li) AND SURFACE-BARRIER DETECTORS. Klyucharev, A. P.; Skakun, N. A.; Poryatui, V. S.; Dikii, N. P.; Zadvornyi, A. S. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1972. 26p. INIS.

Technological operations are presented that are used in the manufacture of silicon-lithium and surface-barrier detectors. A description is given of silicon-lithium detectors having a compensation zone thickness up to 4 mm and a working surface up to 300 mm^2. The working surface of the surface-barrier detectors did not exceed 300 mm^2. The energy resolution is illustrated by spectra from d-sources and elastic protons scattered on targets of ^{12}C, ^{16}O, and ^{27}Al. (SJR)

9584 (ORNL-TM-4614) CALCULATION OF THE RESPONSE OF SILICON DETECTORS OF FINITE RADIUS TO π^- MESONS STOPPING IN TISSUE. Armstrong, T. W.; Chandler, K. C. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 11p. Dep. NTIS $4.00.

Calculated results are presented for the response of silicon detectors of various radii placed in a large region of π^- mesons stopping in tissue. (auth)

9585 UNDOPED HIGH-RESISTIVITY CADMIUM TELLURIDE FOR NUCLEAR RADIATION DETECTORS. Triboulet, R.; Marfaing, Y. (Laboratoire de Physique des Solides, CNRS, 92190 Meudon-Bellevue, France); Cornet, A.; Siffert, P. J. Appl. Phys. 45: No. 6, 2759-2765 (June 1974).

Starting with highly purified feed material, single crystals of semiinsulating CdTe were grown by the use of the traveling heater method, without external chemical compensation. Evaluation of the crystals by the use of electrical and optical measurements showed decisive improvements in quality. Nuclear radiation detectors prepared by the use of this material resulted in an energy resolution (FWHM), at room temperature, of 4.6 and 8.5 keV for γ rays at energies of 122 and 662 keV, respectively. The energy resolution at 122 keV decreased to 3.8 keV at a temperature of -30 °C. No polarization effect was observed. (auth)

9586 STATISTICAL LOSSES OF IMPULSES IN SYSTEMS OF COUPLED-IN-PARALLEL GAS-FILLED IONIZATION COUNTERS. Spassov, V. God. Sofii. Univ., Fiz. Fak.; 65: 303-321 (1970). (In Bulgarian).

A statistical survey of losses in systems of coupled-in-parallel gas-filled ionization counters is made, and the loss factor for the systems in question is obtained as a function of the number of parallel counters, the frequency of impulses, the sensitive time of a single counter and the separative time of the forming channel in regard to a couple of impulses coming in succession. The general function is given for the two-channel radiation well loggers using groups of 3 and 6 coupled-in-parallel Geiger-Mueller counters to provide two conventional radioactivity curves: a neutron-gamma ray log and a natural gamma-ray log. By means of this concretization, some new methods to define more precisely the scale of the recorded curves are suggested which is of particular concern when comprehensive geophysical studies in boreholes are being made. As a conclusion, some data obtained in radiation well logging are cited in witness of the smaller accuracy of the former calibration test compared with the new way of calibration. (auth)

9587 TRACK METHODS OF ANALYSIS. Garnish, J. D. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Proc. Soc. Anal. Chem.; 11: No. 5, 121-123(May 1974).

An account is given of the use of solid state nuclear track detectors (SSTD) to record the passage of charged particles. Many glasses, plastics, and crystalline solids (e.g., mica) are capable of recording and storing damage trails from charged particles. Under appropriate conditions, these trails can be revealed by chemical etching. The process is cheap, simple

and selective. Applications range from cosmic ray identification, through dosimetry and autoradiographic analysis to rock dating and biological filtration. (UK)

9588 INFLUENCE OF TRUE COUNTING RATE AND THE PHOTOPEAK FRACTION OF DETECTED EVENTS ON ANGER CAMERA DEADTIME. Arnold, J. E.; Johnston, A. S.; Pinsky, S. M. (Michael Reese Medical Center, Chicago). J. Nucl. Med.; 15: No. 6, 412-416(Jun 1974).

As true counting rate (N) is increased, an increasing proportion of photopeak events go unrecorded by the Anger camera due to its pulse pair resolving time (T). With increasing radioactive source strength, the observed counting rate (R) is shown to reach a maximum (R_{max}) and then decrease. The resolving time (T) can be estimated by $T = (eR_{max})^{-1}$ and used in the equation $R = Ne^{-NT}$ to predict observed from true counting rate. T does not vary with counting rate until values of N well above those that would produce R_{max} are encountered. However, it is shown that variation in the window width setting or in the degree of scatter in and around the radioactive source will alter the value of T by altering the photopeak fraction (the fraction of detectable events which will fall within the window of the pulse-height analyzer.) Hence methods to correct quantitative data for loss of counts due to instrument deadtime should use correction factors appropriate for the photopeak fraction encountered during the study. Methods of achieving this are discussed. (auth)

9589 SAMPLE CHANGING AND LIGHT SEALING DEVICE FOR LIQUID SCINTILLATION SPECTROMETER. Thomas, E. W.; Scherzer, W. O.; Sicard, F. (to Intertechnique S.A.). US Patent 3,809,897. 7 May 1974. Priority date 27 Mar 1967, France. 10p.

The sample changer is for automatically moving samples from a conveyor into a counting chamber and back to the conveyor and for preventing access of light to the counting chamber. It comprises two shutter assemblies so controlled that they alternately open. One of them comprises a plunger carrying the sample to be moved and which, when lowered, successively clears the way for the other shutter assembly to close and forces down the movable component of an abutment type light seal against the return action of a spring. (Official Gazette)

9590 NUCLEAR ELECTRONICS. Nicholson, P. W. London; John Wiley and Sons, Inc. (1974). 388p.

Various aspects of nuclear electronics are reviewed including radiation detectors, basic pulse circuits, pulse shaping methods for spectroscopy, resolution in spectroscopy systems, amplifiers, pulse height and shape discriminators, timing circuits, multichannel pulse height analysis, and multiparameter and computer analysis. (UK)

9591 ORIENTATION SYSTEM FOR BALLOON-BORNE X-RAY DETECTOR. Seshadri, K. S. V.; Prakasrao, A. S.; Rao, U. R. (Physical Research Lab., Ahmedabad, India). J. Inst. Telecommun. Eng.; 16: No. 6, 434-438(Jun 1970).

An orientation system for pointing a detector to a specific position in the sky, for balloon-borne x-ray astronomy experiments, is described. (INIS)

9592 EVALUATION OF PERFORMANCE OF FOCUSING COLLIMATORS USED IN MEDICAL SCINTIGRAPHY. Dias Neto, A. L. (Univ., Sao Paulo, Brazil). pp 121-123 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From 1st Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

Focusing collimators for medical radioisotope scanning must be chosen according to their spatial resolution, sensitivity and septa penetration. All three parameters have been determined from the response of a collimator to a uniform line source of a proper radionuclide, according to a technique developed at the International Atomic Energy Agency. Four collimators from two scanners were investigated. (WHK)

9593 PORTABLE RADON DETECTOR SUITABLE FOR PERSONNEL OR AREA MONITORING. Costa-Ribeiro, C. (New York Univ., NY). pp 185-186 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From 1st Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

The design of the first prototype was based on the passive radon gas diffusion through an appropriate porous medium to keep airborne radon daughters out of the hemispherical detector chamber. The ^{218}Po ions formed by the decay of radon in the sensitive volume of the instrument were electrostatically collected into an aluminized mylar film. Alpha particles from the decay of ^{218}Po and ^{214}Po which passed through the aluminized mylar, struck a layer of ZnS (Ag) and produced scintillations which were led by a light pipe into the emulsion side of a photographic film specially selected for its sensitivity to the 440 Å radiation emitted by the ZnS (Ag). Upon development of the film the exposure was read by conventional densitometry. (WHK)

9594 METHOD AND ARRANGEMENT FOR DETERMINATION OF PLANAR DISTRIBUTION OF LOW-ENERGY BETA NUCLIDES AND OTHER RADIONUCLIDES FOR TRACER EXPERIMENTS IN BIOLOGICAL, BIOCHEMICAL, AND CHEMICAL EXPERIMENTAL SYSTEMS. Tkyva, R. (to Ceskoslovenska Akademie Ved). US Patent 3,812,360. 21 May 1974. Priority date 8 Jul 1971, Czechoslovakia. 10p.

The planar distribution of low-energy beta nuclides and other radionuclides in different specimens is determined by placing a specimen in a camera provided with a semiconductor detector, generating a relative scanning movement between the specimen and the detector and evaluating the obtained impulses while controlling the scanning as to the length of individual steps and determining simultaneously the contours of the specimen. (Official Gazette)

9595 CONSTRUCTION OF A SIMPLE TRITIUM MONITOR AND A TRITIUM AMPOULE LEAK TESTER USING VA-J-15/15A TYPE X-RAY γ-RAY DOSIMETERS. Weber, K. H.; Kunze, J. (VEB RFT Messelektronik Otto Schoen, Dresden). Kernenergie; 17: No. 2, 59-61(Feb 1974). (In German).

A simple tritium monitor and a device for testing leak rates of glass ampoules were constructed for radiation protection in works with gaseous tritium, in particular in manipulating tritium-filled glass ampoules. An open-air ionization chamber for the monitor and a hermetically sealable ionization chamber for the leak tester were used as the detectors. Measurements of the ionization current are made by means of a somewhat modified x-ray γ-ray dosimeter VA-J-15/15A. The minimum detectable activity concentration relative to four-fold background is 10^{-6} Ci/l, and the minimum detectable leakage rate is 10^{-6} Ci/h at a period of 24 h for one test. (auth)

Radiation Dosimeters

Refer also to abstracts 11665, 11683, and 12003.

9596 (COO-1105-204) DISCLOSURE TO USAEC COMPTON-EFFECT TAP/TAD DOSIMETER. Moran, P. R. (Wisconsin Univ., Madison (USA). Medical Physics Labs.). 2 Mar 1974. 1p. Dep. NTIS $4.00.

The forward scattered Compton electrons, if a solid is exposed to high energy x-rays or gammas, can trap to give a Compton-effect induced electrical polarization. When the material is heated to the point of onset of electrical conductivity, depolarization results. This can be read-out as a current between short-circuited electrodes as is presently done for the electret or local RITAD dosimetry effect. Although relatively insensitive, the Compton-effect TAD device, has many features important for certain special dosimetry applications. (auth)

9597 (COO-1105-205) THIN FILM "TRITIUM" DOSIMETRY. Moran, P. R. (Wisconsin Univ., Madison (USA). Medical Physics Labs.). 1 Mar 1974. 1p. Dep. NTIS $4.00.

Certain materials show quite reasonable RITAP dosimetry properties and, moreover, can easily be fabricated into thin films. In contrast to TL, for example, RITAP sensitivity is thickness independent. Thus, radiation whose energy is deposited only very close to the solid surface of incidence can be measured efficiently using a thin film dosimeter TAC technique. An important application is personnel body-water tritium monitoring. (auth)

9598 (COO-1105-206) IMPROVING CHARACTERISTICS OF TL DOSIMETRY DEVICES BY SELECTIVE PURIFICATION OF STARTING MATERIALS. Moran, P. R. (Wisconsin Univ., Madison (USA). Medical Physics Labs.). 20 Mar 1974. 8p. Dep. NTIS $4.00.

Heretofore, high sensitivity TL phosphors have been produced from nominally pure starting materials by heavily doping with impurity activators. The resulting TL phosphors often show undesirable characteristics in addition to the desired enhancement of TL sensitivity produced by the doping procedure. We have discovered an alternative method for producing high sensitivity TL phosphors; rather than heavily doping nominally pure starting materials, we selectively purify nominally pure materials to remove certain classes of active impurity centers which nor-

mally are present and appear to inhibit the TL process. We find that this procedure yields TL phosphors whose sensitivity is comparable with that produced by heavy doping, but whose other characteristics, e.g., response nonlinearity, complex pre-irradiation annealing procedures, and sensitivity stability, appear to be quite superior to those observed in the heavily doped phosphors. (auth)

9599 (GSF-K-76) PERSONNEL DOSIMETRY. Wachsmann, F. (Gesellschaft fuer Strahlen- und Umweltforschung G.m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). May 1973. 45p. (In German). INIS.

The dosemeters used in the FRG for radiation protection purposes according to the 1st Radiation Protection Ordinance and the new X-Ray Decree are reviewed, including registration and evaluation of doses. (GE)

9600 (IAEA-R-837-F) DIRECT INTERNAL RADIATION DOSIMETRY OF RADIOPHARMACEUTICALS BY IMPROVED NEEDLE-TYPE FLUOROGLASS DOSIMETER. Final Report, 1 November 1969–30 November 1972. Iio, M. (International Atomic Energy Agency, Vienna (Austria)). Jan 1973. 11p. INIS.

The purpose of this project was to modify the existing rod-type fluoroglass dosimeter for measuring the internal radiation dose induced by radiopharmaceuticals used in the field of nuclear medicine. The rod type fluoroglass dosimeter (Fluorod) developed by Yokata was improved. The new Fluorod has the following advantages: energy dependency is reduced; pre-dose is lower; and it can be cut easier in the accurate size of 1 mm $\phi \times 6$ mm. In order to be able to measure the low-level radiation exposure at 3 mR, several modifications and improvements of the Fluorimeter system such as a super high-pressure mercury lamp with high-intensity point source and parabolic mirror were used. The linearity and higher sensitivity of the system has been proved and comparison with other systems shows the advantages of this system. In spite of the success in in vitro studies, the vivo application needs further refinement of the technique which is not related to instrumentation but to the procedure of the operation and administration of radiopharmaceuticals. (INIS)

9601 (INIS-mf-1173) MANUAL OF DOSIMETRY IN RADIOTHERAPY. Volumes 1 and 2. Gomez, A.; Gonzalez, R.; Lindenboim, D. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Aug 1973. vp. (In Spanish). INIS.

The manual is intended for professionals and technicians without previous knowledge of nuclear physics terms or data. After a glossary of terms and magnitudes used in dosimetry and an indication of the units applicable, the following topics are discussed: elements of atomic physics and radioactivity, interaction of radiation with matter, x-ray equipment and x-ray properties, dosimetry of linear γ sources, dosimetry of point γ sources, dosimetry instrumentation, planning of static and kinetic teletherapy, calculation of wedge filters, integral doses in teletherapy, shielding calculations, and basic safety standards. The methods for the following problems are described: testing and calibration of an x-ray therapy installation, calibration of a telecobalt therapy installation, and tracing isodose curves in telecobalt therapy installations and centering oblique fields. (tr-auth)

9602 (KFK-1609) USE OF CaF_2 THERMOLUMINESCENT DOSIMETERS FOR MEASURING NATURAL BACKGROUND RADIATION. Burgkhardt, B.; Piesch, E. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Strahlenschutz und Sicherheit). Mar 1972. 7p. (In German and English). INIS.

Various solid state dosimetry systems are now available for measuring the natural background radiation level. Silver-activated phosphate glass dosimeters, which have already been in use for many years, can accumulate several years' exposure even with intermediate readouts. They only measure, however, exposures of over 40 mR, which requires an exposure time of about 6 months. In contrast, LiF dosimeters make it possible to measure exposures of 5 mR. However, in order to be also able to measure short-term fluctuations of the natural background radiation level due to additional radiation sources in the near vicinity of nuclear engineering facilities, it is necessary to use even more sensitive dosimeters. Good results have been obtained so far with $CaSO_4$: Dy dosimeters, which indicate exposures above 20 μR. However, CaF_2 dosimeters also make it possible, in conjunction with commercial evaluation systems, to measure exposures of 0.1 mR. The results of investigations on CaF_2(nat) dosimeters type PNP 090 [B1] are presented. The dosimeters were read out in the evaluation device TL-Reader PNH 801 [B1]. In addition, the possibilities of use of this dosimetry system, in comparison with other solid state dosimeters, are also discussed. (GE)

9603 USE OF RADIOTHERMOLUMINESCENT DETECTORS IN RADIOPHOTOLUMINESCENCE DOSIMETRY. Laconi, A.; Caffarelli, F.; Brancato, G.; Polizzi, A. (Univ., Palmero, Italy). Minerva Med.; 64: 3801-3804(17 Oct 1973). (In Italian).

Lithium fluoride crystals can be used as radiation detectors by exploiting either thermo- or photo-luminescence in accordance with the different characteristics of absorption centers. Dose-response proportions are evident with either method. Thermoluminescence is more suitable in dosimetry, since it is appreciable at low doses, whereas photoluminescence is limited in this respect. Comparisons are made between certain features of these two responses in the case of lithium fluoride. (auth)

9604 PROPERTIES OF GRID-INDEPENDENT PORTABLE DOSIMETERS MANUFACTURED IN COMECON COUNTRIES. Kraus, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin); Herrmann, D.; Schaup, K. P.; Helmstaedter, K.; Hecker, O. Isotopenpraxis; 10: No. 2, 41-55(Feb 1974). (In German).

Some essential technical properties of dosimeters manufactured in COMECON countries are tested and compared using individual meters. The possibilities of using these meters in routine dosimetry for the measurement of the dose or dose rate of quantum and β-radiation, for the measurement of surface α- and β-contamination and of β- and γ-liquid contamination, as well as of neutrons are discussed. (auth)

9605 EMPLOYMENT OF FILM DOSIMETRY IN THE ROUTINE PRACTICE OF IRRADIATION PLANNING ON A TELECOBALT DEVICE. Strueter, H. D.; Halama, J. (1972). vp. (In German).

From joint meeting of the Deutsche Gesellschaft fuer Biophysik e.V., and the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Erlangen, Ger. (4 Oct 1972).

The application of film dosimetry with a parallel incidence of rays is discussed in the routine of practice of irradiation planning. By the appropriate organization and apparatus, it is possible to reduce the exposure, development, and measuring times to such an extent that with about 10 hours work it is possible to measure 15 separate dose distributions. After preliminary tests on the measuring accuracy of the film dosimetry method, examples of its application are discussed. Besides modification of the standard irradiation plans for the individual type of equipment, the user may adopt this method optimally to his own purpose. Financially smaller institutes can also afford this method. (GE)

9606 CALIBRATION OF RADIOTHERAPY MACHINES IN THE RANGE 1 TO 30 MeV X-RAYS AND ELECTRONS. Almond, P. R. (Univ. of Texas, Houston). pp 1-34 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From 1st Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

A review of radiation units is given showing the necessity of a new unit, besides the roentgen, for high energy x-rays and electrons. This led to the introduction of the rad. Methods of calibrating high energy x-ray and electron beam machines in terms of rads is then discussed. Three methods are considered, calorimetry, ferrous sulphate chemical dosimetry, and calibrated ion chambers. It is shown that the expected errors for all methods are of the order of 2 to 3%, therefore, due to their increased precision and ease of use the ion chambers are to be preferred. To see if commercially available chambers can be used, the proposed method for ion chambers was checked with 14 different ion chambers and agreement to within ±2.0% was found. (38 references) (auth)

9607 THERMOLUMINESCENCE DOSIMETRY IN DIAGNOSTIC X-RAYS. del Vigna Filho, E. (Univ., Sao Paulo, Brazil); Watanabe, S.; Pereira, A. J.; George, L. L. pp 86-91 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From 1st Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

Harshaw's TLD-100 micro rods were used for radiation dosimetry during x-ray diagnosis at the Hospital A. C. Camargo, Sao Paulo. In each case two couples of dosimeters contained in plastic tubes were placed at central beam point on the skin of the patient, one at the entrance and the other one at the exit. Measurements include the following kinds of x-ray examination: chest, knee, lombar spinal cord and dorsal spinal cord. About 40 patients for each kind of examination were considered, and two different x-ray machines, Giganthos and Neo-Heliopjos, were used. In most of the cases, high exposures are involved. (auth)

9608 ROENTGENS AND ABSORBED DOSE MEASUREMENTS WITH THE RADOCON II OR CONDERSEN R-METER. Bellian, J. G. (Victoreen Instrument Div., Cleveland). pp 150-166 of

First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From 1st Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

The operation and uses of the Condenser R-Meter and the Radocon II for absorbed dose measurements are discussed. Proper probe selection according to the photon energy range to be measured is described. (WHK)

9609 REVIEW OF RECENT DEVELOPMENTS IN INSTRUMENTATION FOR RADIATION DOSIMETRY AND NUCLEAR MEDICINE. Schutz, D. F.; Webb, G. A. M. (Teledyne Isotopes, Westwood, NJ). pp 167-184 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From 1st Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

Methods for detection and dosimetry of radiation based on luminescence are reviewed. Radiophotoluminescent dosemeters, thermoluminescent dosemeters, and scintillation detectors are briefly discussed. (WHK)

9610 EFFICIENCY OF A FOUR-STAGE READOUT CYCLE IN ANNEALING FOR REUSE OF THERMOLUMINESCENT LiF DOSIMETERS. Webb, G. A. M.; Schutz, D. F.; Phykitt, H. P. (Teledyne Isotopes, Westwood, NJ). pp 187-220 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From 1st Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

For many years it has been found necessary to anneal lithium fluoride in an oven before reuse. The standard annealing cycle has three components, first, maintenance at a high temperature, followed by cooling to 80°C, and then maintenance for 24 hours. An attempt has been made to replace all these components by modifying the heating cycle during readout. The modified cycle has four stages. Preheat for 12 seconds; readout at a fixed temperature for a further 12 seconds; anneal at a high temperature for 20 seconds; cool rapidly and reproducibly in a nitrogen gas stream. Integration of signal is carried out only during readout, the other three stages are solely for annealing. The high temperature anneal zeroes the dosimeters, the cooling is highly reproducible and the pre-heat bleaches out the low temperature peaks before integration commences. The efficiency of this four-stage cycle has been employed in a new readout instrument, the TLD 7300. The high temperature anneal leaves less than 0.03% residual signal. The reproducible cool rate brings sensitivities of different batches of dosimeters within ±5% by cycling once through the readout cycle. The performance of the pre-heat has been studied by glow curve analysis and by fading studies. The cycle is found to adequately replace the oven annealing for many applications, especially at low dose levels. (auth)

9611 ALKALI METAL-ACTIVATED BeO AS A HIGHLY SENSITIVE EXOELECTRON DOSIMETER. Boros, L. (Ungarische Akademie, Budapest). Acta Phys. Acad. Sci. Hung.; 34: No. 2-3, 255-269(1973). (In German).

A highly sensitive miniature thermally stimulated exoelectron emission dosimeter was prepared from BeO ceramics doped with alkali metals. The lower dose detection limit is reproducible at 1 mR. The dosimeter reading is energy and angular independent and is dose linear and proportional. The effect of the ratio in the dosimeter preparation and of the radiation quality and perturbation factors on the glow curve was studied. The occurrence of cooling maximum was observed in the case of thick sensitive layers. The use of this dosimeter is recommended in microdosimetry, in vivo dosimetry, and for the measurement of low radiation doses. (tr-auth)

9612 EVALUATION OF DATA FROM CONDENSER IONIZATION CHAMBERS. Fronko, A.; Krizek, V.; Landovsky, J.; Plestil, Z.; Vit, V.; Pavlicek, Z.; Moucka, L.; Cernavsky, J. Czech Patent 146,510. 15 Dec 1972. 3p. (In Czech).

A contactless transmission of the signal from condenser ionization chambers to an evaluation device placed outside the hermetically sealed space of the dosemeter condenser is proposed. This represents a way of evaluating data obtained by condenser ionization chambers. The charge of the dosemeter condenser affects inductively the measuring gage via the coupling capacitor, by changing the capacity of either the dosemeter or the coupling capacitor. The resulting change is dependent on the charge of the dosemeter condenser. (INIS)

9613 PERSONAL DEVICE FOR SIGNALLING HARMFUL DOSES OF X- AND GAMMA-RADIATION. Koci, J. Czech Patent 146,771. 15 Dec 1972. 5p. (In Czech).

A personal device signaling harmful doses of x and gamma radiation is proposed which will notify personnel of radiation hazards in work with radioactive substances. The device consists of an electrically conductive ionization chamber with an electrode system, of a shock-proof relay, and of a housed electroacoustic or electrooptical signal system. (INIS)

9614 THERMALLY STIMULATED EXOELECTRON DOSIMETERS AND THEIR USE IN THE MEDICAL RADIOLOGY. Boros, L.; Szy, D.; Zsebok, Z. Magy. Radiol.; 26: No. 2, 112-116(Apr 1974). (In Hungarian).

The exoelectron dosimeters constructed open new possibilities in dosimetry because of their small sensibility, little volume, their great sensibility in the energy and LET domain, good reproducibility and other advantageous dosimetric properties. Because of the simplicity of the evaluation apparatus and the low price of the detectors the use of these dosimeters is advantageous also in the routine individual and therapeutic dosimetry. (auth)

9615 CHEMICAL DOSIMETRY OF A HIGHLY ACTIVE COBALT-60 IRRADIATION SOURCE. Garcia Sosa, I. M. E. Orizaba, Mexico; Niversidad Veracruzana (1974). 105p. (In Spanish).

Thesis.

The dose in various parts of a quadrant containing a ^{60}Co source was measured with a Fricke dosimeter and with a modified form of this dosimeter using the oxidation of the ferrous ion to the ferric ion. The experimental techniques are reported in detail. The response obtained by both dosimeters was linear. The experimental results showed that the arrangement of the 12 tubes of ^{60}Co cylinders produces a point source. (JSR)

Nuclear Spectroscopic Instrumentation

Refer also to abstracts 10565 and 10573.

9616 (COO-2231-21) ENERGETIC-NEUTRON SPECTROMETRY. Annual Progress Report, 1 April 1973–31 March 1974. Madey, R.; Waterman, F. M.; Baldwin, A. (Kent State Univ., Ohio (USA)). 1974. Contract AT(11-1)-2231. 76p. Dep. NTIS $7.00.

Initial steps have been taken to modify a self-contained time-of-flight spectrometer for unidirectional neutrons in order to extend its capability to measure omnidirectionally incident neutrons. To measure the spectrum of omnidirectionally incident neutrons, it is necessary to measure two parameters, namely, the energy of the recoil-proton in the first detector in addition to the energy of the scattered neutron. The principle of the two-parameter measurement technique was confirmed in a measurement of the neutron spectrum produced at 0° from 71-MeV deuteron bombardment of a thick carbon target at the University of Maryland cyclotron. This measurement established also an improved technique for subtracting backgrounds in unidirectional spectral measurements. To measure omnidirectionally incident neutrons from 5 to about 150 MeV, it was necessary to design and construct an improved linear gate and stretcher with a potential dynamic range of 600 to 1, to design and procure a large 10 in. by 10 in. by 4 in. (NE-102 plastic) first detector, and to design and construct a 10 in. by 10 in. by 4 in. aluminum chamber for encapsulating the NE-228 liquid first detector. The ability of the spectrometer to measure omnidirectionally incident neutrons was tested in a simulated omnidirectional spectral measurement at the University of Maryland cyclotron using the neutron beam produced at 0° from 82-MeV deuteron bombardment of a thick beryllium target. To simulate a spectral measurement of omnidirectional neutrons, measurements were made with the neutron beam incident on the spectrometer at angles of 20°, 45°, and 75°. These data are presently being analyzed. (auth)

9617 (IAEA-R-855-F, pp 62-73) CORRELATION METHODS IN NEUTRON SPECTROMETRY. Pellionisz, P. (ed.). Oct 1972.

A short summary is given of the new experimental methods developed and used in correlation neutron spectroscopy studies. Equipment for spin-flipping and magnetic pulsing as well as a mechanical correlation chopper have been built. New methods have been developed and applied for correlation time-of-flight spectrometry and diffractometry and for filtering out certain spectrum components or separating elastically from inelastically scattered neutrons. The application of correlation methods has been extended to pulsed neutron sources. (auth)

9618 (JEN-247) NEW APPROACH TO BETA–GAMMA COINCIDENCE COUNTING. Advance Report on the "SAMAR" Electronic System. DeCarlos, J. E.; Granados, C. E. (Junta de Energia Nuclear, Madrid (Spain)). 1972. 42p. (In Spanish). INIS.

In $4\pi\beta-\gamma$ coincidence measurements, precision of the evaluation of coincidence counting losses is made difficult because of complex overlapping effects between the β- and γ-side dead times due to precursive counted events. In this context, the SAMAR electronic system is aimed to give a precise way of automatic counting and reduce the need for calculated corrections. Its configuration and basic features are described. The SAMAR has been conceived in such a manner that both beta and gamma chains are sharing a common and nonextending dead-time which is simultaneously applied to both channels. The shared dead time is made to be the only one inserted throughout the chains. Overlapping effects vanish and the three counting channels have identical transmission ratios. A new dead-time circuit based on fast linear gates as blocking elements has been developed. Application of the two-oscillator Mueller method evidences a fully nonextending character. Automatism is implemented by using a live timer corrective channel controlling the counting scalers. (auth)

9619 (NIIAR-P-182) MEASUREMENTS OF SPECTRA OF INTERNAL CONVERSION ELECTRONS BY BETA SPECTROMETER WITH SILICON DETECTOR AND COLLECTING MAGNETIC FIELD. Morozov, V. I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Melekess (USSR)). 1973. 18p. (In Russian). INIS.

Consideration is given to a number of problems in the use of a beta spectrometer having a Si(Li) detector and a collecting magnetic field for measuring internal conversion electron (ICE) spectra during the radioactive decay of nuclei. Basic relations are presented for calculating the efficiency of collecting and counting electrons with a Si(Li) detector in the magnetic field of the solenoid. An estimate is given of the effect of solenoid field inhomogeneity on the efficiency of collecting electrons. A discussion is given on the possibilities of beta spectrometry in measuring internal electron conversion spectra during decay of radioactive nuclei by k-capture and by beta-decay. The possibility of the successful use of beta spectrometry is shown in the study of spectra of conversion electrons from the decay of short-lived nuclei (with a half-life on the order of a few tenths of a minute). (SJR).

9620 (NIIAR-P-203) SUMMING Ge(Li) COMPTON SPECTROMETER. Ivanov, V. B.; Shipilov, V. I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1973. 25p. (In Russian). INIS.

Experimental results are presented on a summing Compton spectrometer with two planar Ge(Li) detectors made on a single bar of germanium. It is shown that this spectrometer, starting from a ratio of phonon and useful activity equal to 4 becomes more sensitive than a single-crystal spectrometer in the energy range of 0.5 to 2 MeV. Theoretical expressions are given for comparing gamma spectrometers. (SJR).

9621 (NIIAR-P-205) CALCULATION OF GAMMA-RAY ABSORPTION WHEN USING SCINTILLATION SPECTROMETERS. Polyakov, V. I.; Chechetkin, Yu. V. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1973. 11p. (In Russian). INIS.

It is shown that by using scintillation gamma spectrometers, the taking into account of gamma ray exponential attenuation in the source and shielding with narrow-beam values of the attenuation coefficient can lead to errors as a result of counting scattered radiation under the photopeak. A formula is obtained from which it is possible to calculate the effective attenuation coefficient of the gamma quanta at any resolution of the spectrometer and any method of "cutting out" the photopeak. The applicability of the formula is confirmed experimentally. (SJR)

9622 EXPERIMENTAL COMPARISON OF MULTI-CHANNEL ANALYZER. Dead-Time Corrections for Short-Lived Radionuclides. Huysmans, K.; Gijbels, R.; Hoste, J. (Univ., Ghent). J. Radioanal. Chem.; 20: No. 1, 51-69(1974).

The accuracy of the live-time circuit of a 400-channel analyzer was studied in detail, and was found to be unsatisfactory even for long-lived radionuclides. It was found that automatic live-time correction with the multi-channel analyzer gave rise to increasing positive errors with increasing count rate; this overall positive error was composed of a positive error due to the slowness of the electronic circuitry, and a smaller negative error due to the finite pulse-width. Adequate correction could be performed by feeding the information from the dead-time output of the multi-channel analyzer to an external live-time circuit with variable oscillator frequency and pulse-width. Four methods for dead-time correction were compared experimentally in the case of short-lived radionuclides (T as low as 7 sec): the method of Bartošek et al., the method of Schonfeld, the use of a sufficiently short counting time as compared to the half-life, and the live-time mode of countint without additional correction. These four methods were applied to the determination of oxygen and silicon in rocks by 14 MeV neutron activation analysis. Results are given for USGS standard rock G-2. (auth)

9623 CORRECTIONS OF COUNTING LOSSES IN GAMMA-SPECTROMETRY OF SHORT-LIVED RADIONUCLIDES. Junod, E. (CEN, Grenoble, France). J. Radioanal. Chem.; 20: No. 1, 113-134(1974).

A short-lived radionuclide is characterized essentially by the decrease of its activity even while it is counted. The relations used between the number of counts recorded in a given time and the half-life in order to obtain the true counting rate are reviewed. Moreover, in gamma-spectrometry with multichannel analyzers having variable dead-time, counting losses are observed. Exact corrections are calculated for pure short-lived radionuclides and for mixtures of one short-lived and one or more long-lived radionuclides. Based on these calculations, the approximations given by the built-in "live-timer" device of the analyzers and by a new "actual-time" concept (with external live-time measurement) are evaluated. Curves are drawn as functions of the ratio counting time vs. half-life, to ensure minimal errors of less than 1%. (auth)

9624 USE OF THE COINCIDENCE TECHNIQUE IN NUCLEAR EXPERIMENTS. Mori, A. M. Mexico City; Universidad Nacional Autonoma de Mexico (1973). 91p. (In Spanish).

Thesis.

The principal electronic coincidence methods are described and an example of their use is shown experimentally using the Compton effect and a Compton polarimeter. The expressions for Compton collision cross sections are developed. The production of γ radiation with plane polarization and its interaction with matter are studied. The instruments used in the experimental study and the study of Compton kinematics are described. The principal parameters used in Compton polarimeters and the experimental results obtained with a simple polarimeter operated at 312 keV are discussed. (tr-auth)

High Energy Physics Instrumentation

Refer also to abstracts 10517, 10562, and 11120.

9625 (ANL/HEP-7414) PERFORMANCE OF THE ARGONNE 12-FOOT BUBBLE CHAMBER. Track Sensitive Target Construction and Operating Conditions. Jaeger, K.; Leutz, H. (Argonne National Lab., Ill. (USA); European Organization for Nuclear Research, Geneva (Switzerland)). Mar 1974. 69p. Dep. NTIS $6.50.

The performance of the Argonne 12-foot bubble chamber, which has been in operation since Sept. 1970, is described. Chamber parameters, particle beams, and experiments for the chamber are discussed. Also, the track-sensitive target program at the 12-foot chamber is reviewed. (WHK)

9626 (CERN-74-12) GENERAL-PURPOSE AMPLIFIER AND READOUT SYSTEM FOR MULTIWIRE PROPORTIONAL CHAMBERS. Lindsay, J.; Millerin, C.; Tarle, J. C.; Verweij, H.; Wendler, H. (European Organization for Nuclear Research, Geneva (Switzerland)). 20 May 1974. 45p. Dep. NTIS (US Sales Only) $5.25.

An amplifier and read-out system for multiwire proportional chambers is described. It consists of the following elements: preamplifiers; receiver, trigger, and memory modules; proportional system encoder; a powered crate; and wire chamber interfaces. The preamplifiers are mounted directly on the chamber, from which signals are sent via twisted pair cables to the receiver, trigger, and memory modules, housed in crates in the experimenters' hut. Each crate contains a proportional system encoder which codes and transmits the data from up to 22 receiver, trigger, and memory modules (352 wires), after a request from the wire chamber interface. The latter module can handle information from up to eight systems of 4096 wires (32,768 wires). The input sensitivity is nominally 2.4 μA. The minimum fast strobe width is 10 nsec. The time slewing and the delay dispersion, etc., are small; thus full advantage can be taken of the intrinsic resolving time of multiwire proportional chambers when using the system. (auth)

9627 (CONF-720737–, pp 3-111) RECENT DEVELOPMENTS IN HIGH ENERGY COUNTER EXPERIMENTS. Chamberlain, O. (Univ. of California, Berkeley). Dec 1972.

From Proceedings of the 1972 KEK summer school; Ibaraki, Japan (17 Jul 1972).

Five review papers by Owen Chamberlain are presented. The topics include: (1) new detector development; (2) recent work at the Bevatron; (3) polarized targets; (4) PEP: the proposed Positron-Electron-Proton Accelerator; and (5) plans for work at the National Accelerator Laboratory. (WHK)

9628 (COO-2146-5) NUCLEON–NUCLEON POLARIZATION CORRELATION EXPERIMENTS IN THE 300 TO 800-MeV RANGE. Technical Progress Report for a Program in Medium Energy Nuclear Physics Research, 1 September 1973–31 August 1974. Willard, H. B. (Case Western Reserve Univ., Cleveland, Ohio (USA). Dept. of Physics). 24 May 1974. Contract AT(11-1)-2146. 13p. Dep. NTIS $4.00.

Multiwire proportional chambers, readout electronics and a PDP 11/45 data acquisition system have been constructed and installed at LAMPF preparatory to measuring p–p differential scattering cross sections at 800 MeV. Preliminary test runs with the external proton beam at LAMPF indicate that all components are functioning approximately as anticipated except for the wire chambers. These chambers do not have 100% absolute efficiencies nor is the uniformity across the planes precise enough for 1% data. Further tests with different gas mixtures and high voltage settings are in progress. (auth)

9629 (EFI-4-72) IDENTIFICATION OF HADRONS WITH THE ENERGY OF 100 TO 200 GeV BY THE TRANSITION RADIATION MEASUREMENT METHOD IN COMBINATION WITH THE CALORIMETER. Avakyan, V. V.; Alikhanyan, A. I.; Gavukchyan, S. M.; Kankanyan, S. A.; Mamidzhanyan, E. A.; Margaryan, A. T.; Oganesyan, A. G.; Pleshko, M. P.; Tamanyan, A. G. (Erevanskij Fizicheskij Inst. (USSR)). 1972. 19p. (In Russian). INIS.

The coefficient of rejection of 500- to 3000-GeV/c pions and protons for an RPI detector was calculated by the Monte Carlo method. An experiment for measuring the spectrum of single cosmic pions and protons is described. (tr-auth)

9630 (EFI-5-72) FILMLESS SPARK CHAMBERS WITH ON-LINE COMPUTERS. Kievalin, V. A.; Petrakov, A. V. (Erevanskij Fizicheskij Inst. (USSR)). 1972. 31p. (In Russian). INIS.

The first part of this review notes the development and achievements of the filmless recording of information in the last five years. The second part of the review considers the connection of the spark chamber with the digital computer. A formulation is given for the main requirements of digital computers directly connected to experimental devices. Examples are presented for constructing systems of the filmless recording of information with ferritic magnetostrictive, sonic, and video film chambers. (SJR)

9631 (EFI-ME-14(72)) LARGE USEFUL AREA SCINTILLATION HODOSCOPE FOR A MAGNETIC SPECTROMETER. Abramyan, L. O.; Agan'yants, A. O.; Vartapetyan, G. A.; Demekhina, N. A.; Israelyan, M. Kh.; Lebedev, A. N.; Muradyan, E. G.; Khudaverdyan, A. G. (Erevanskij Fizicheskij Inst. (USSR)). 1972. 9p. (In Russian). INIS.

A description is given of three hodoscopes for a 0.8 to 4.0 GeV/c magnetic spectrometer with scintillator sizes of $2.5 \times 1 \times 25$ cm^3 (7 pieces) or $3 \times 1 \times 25$ cm^3 (10 pieces). The efficiency of a separate hodoscopic counter was ~97%. The grounds for selecting the sizes of the plastic scintillators and the form of the light guides are presented. In order to study the optical properties of the hodoscopic counters the beta spectrum of ^{144}Pr was taken by means of these counters. The hodoscopes have operated over a number of years without any loss in efficiency. (SJR).

9632 (IFVE-SEF-72-83) FERRITE CORE READOUT SYSTEM FOR WIRE SPARK CHAMBERS. Karpekov, Yu. D.; Makarov, G. P.; Sergeev, V. A.; Simonov, Yu. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 8p. (In Russian). INIS.

A system is described for reading out information from wire spark chambers containing up to 63,000 wires with a ferrite core memory. As desired, it is possible to question all groups of the circuit or only the groups of the circuit carrying information on addresses of the wire spark chambers. (SJR)

9633 (IFVE-SEF-72-118) CHARACTERISTICS OF WIRE SPARK CHAMBERS WITH FERRITE CORE READOUT. Karpekov, Yu. D.; Konstantinov, V. F.; Makarov, G. P.; Prokhorov, A. N.; Sergeev, V. A.; Simonov, Yu. N.; Sugonyaev, V. P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 9p. (In Russian). INIS.

Characteristics are presented on unitized wire spark chambers with acceptance of information on ferrite cores and ohmic uncoupling of high-voltage electrode wires. The counting characteristics and spatial resolution were investigated as a function of the nominal rating of the uncoupling resistors. The efficiency of counting 10 simultaneous particles exceeds 95%. (SJR)

9634 (IFVE-SPK-72-117) CATALOGING DATA IN HANDLING PICTURES FROM BUBBLE CHAMBERS AT IFVE. Gorichev, P. A.; Klimenko, S. V.; Petrovykh, L. P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 10p. (In Russian). INIS.

A description is given of the INDEX program operating on a BESM-6 digital computer for cataloging data in a system for handling photographs from bubble chambers at IHEP. (SJR)

9635 (IFVE-SPK-73-18) CALCULATION OF KINEMATICAL PARAMETERS OF ELECTRON TRACKS IN GEOMETRICAL PROGRAM HAZAR. Ammosov, V. V.; Belokopytov, Yu. A.; Bryzgalov, V. V.; Gerdyukov, L. N.; Kistenev, E. P.; Klimenko, S. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 9p. (In Russian). INIS.

This study describes a method of calculating the kinematic parameters of electron tracks with multiple scattering and radiation and ionization energy losses being taken into account. Results are presented on the treatment of artificial tracks and of real events. (SJR)

9636 (ITEF-1) DATA ACQUISITION SYSTEM AND MEMORY DEVICES FOR MAGNETOSTRICTION WIRE SPARK CHAMBERS. Kanavets, V. P.; Martynov, V. L; Morozov, B. V.; Potapov, N. L; Ryl'tov, V. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 14p. (In Russian). INIS.

A system of electronic circuits is described for taking and storing information from wire magnetostrictive spark chambers for input to a Razdan-3 digital computer. (SJR)

9637 (JINR-13-7254) MODIFIED TAPE DRAWER OF THE PHOTOGRAPHIC APPARATUS FOR THE JINR 2 m HYDROGEN BUBBLE CHAMBER "LUDMILA". Tape Drawer Pneumatic Control. Bulanov, N. F.; Bogomolov, N. V.; Viryasov, N. M.; Vyskochil, S.; Sil'nichenko, A. F.; Tolmachev, V. T.; Rusakov, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 18p. (In Russian). INIS.

Improvements are described in the construction of the kinematic unit, the functional scheme and pneumatic control of the film-extension mechanism (ULM-50) used to photograph the volume of a 2-meter, hydrogen bubble chamber. Technical characteristics of the film-extension mechanism are presented. (SJR)

9638 (JINR-P13-7783) CHERENKOV SPECTROMETER WITH THE WATER RADIATOR. Ganichev, V. I.; Kruglov, V. V.; Kulikov, A. V.; Kuptsov, A. V.; Nemenov, L. L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A Cherenkov spectrometer having a $500 \times 500 \times 500$ mm^3 radiator of distilled water sensitized with dipotassium salt of amine-G-acid is described. The spectrometer enables one to measure the electron energy in the range from 20 to 120 MeV. At energies less than 100 MeV the energy resolution of the water spectrometer exceeds noticeably the analogous value for total absorption glass spectrometers. (auth)

9639 (JINR-P13-7791) EFFECT OF THE HIGH-VOLTAGE PULSE PARAMETERS ON THE GEOMETRICAL AND BRIGHTNESS CHARACTERISTICS OF THE STREAMER IN A STREAMER CHAMBER. Glagoleva, N. S.; Lukstinsh, Yu. R.; Matyushin, A. T.; Matyushin, V. T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

An approximate calculation is presented for geometrical and relative brightness characteristics of the streamer in a streamer chamber depending on the high-voltage pulse parameters. The calculation was performed based on the streamer mechanism of the development of a charge without account for the statistical fluctuations. The effect of the form of a real unipolar pulse is taken into account by reducing it to the equivalent rectangle. It is shown that reduction of the pulse duration by 3 to 4 times, at a corresponding decrease of an amplitude, can result in the increase of the streamer brightness by an order of magnitude. (auth)

9640 (JINR-P13-7811) APPARATUS FOR CONTROLLING OPERATING CONDITIONS OF TWO-METER STREAMER CHAMBER. Volodin, V. D.; Glagoleva, N. S.; Kuznetsov, P. S.; Matyushin, A. T.; Matyushin, V. T.; Shevchenko, E. N.; Oleinichak, V.; Firkovskii, R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1974. 26p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

Apparatus for controlling operating conditions of two-meter streamer chamber is described, guaranteeing continuous controlling

of parameters of a high-voltage pulse on electrodes (amplitude, duration, delay). Measurements of absolute values of the field intensity in the chamber have been performed with the accuracy of 5 to 7%. The advantages have been checked of constructive realization of an electron apparatus having the form of a functionally closed set of electron stands and devices positioned on a movable platform for experiments with the JINR accelerator. (auth)

9641 (JINR-P13-7867) SELFSIMILAR BEHAVIOR OF VAPOR BUBBLE IN BUBBLE CHAMBERS. Tkachev, L. G.; Shestakov, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The consequences of covariance equations for describing the behavior of the homogeneous vapor bubble with respect to the transformation of independent variables both with constant and variable time-dependent pressure in a liquid, in particular, in the ultrasonic field are considered. The covariance of equations leads to the automodel dependence of the bubble radius upon time, which is confirmed by numerical calculations. (auth)

9642 METHODS FOR MEASUREMENT AND INITIAL PROCESSING OF BUBBLE-CHAMBER DATA. Pose, R. A. (Institute of High-Energy Physics). Sov. J. Particles Nucl.; 4: No. 3, 350-362(Jan 1974).

Some basic methods of data processing for bubble chamber pictures are considered. The main attention is paid to the filtering of information in various data handling systems. It is shown, that the used methods for filtering data can be reduced to a small number of ideas and that these systems mainly differ in the distribution of functions between man, device and computer. (auth)

Radiometric Instruments

9643 (INPT-33) QUESTION OF THE FAST NEUTRON ABSORPTION IN MOISTURE MEASUREMENTS BY THE NEUTRON METHOD. Kreft, A. (Institute of Nuclear Physics and Techniques, Krakow (Poland)). Jun 1973. 20p. Dep. NTIS (US Sales Only) $4.00.

Fast neutron absorption is discussed from the point of view of the calibration of neutron moisture gages. An approximated method is proposed for calculating the probability that the neutron of a given energy would escape the absorption during slowing down in the medium. The method has been employed for water-saturated sandstone, limestone, dolomite, and some types of soils. It was shown that the probability of non-capture in slowing down depends on the moisture content of the soil and changes in the range over a dozen percent. (auth)

9644 (UCID-16475) COMPARISON OF THE DATA FROM AN EPITHERMAL NEUTRON LOG TO WATER CONTENT MEASURED FROM IN SITU SAMPLES IN YUCCA FLAT, NEVADA TEST SITE. Hearst, J. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 May 1974. Contract W-7405-eng-48. 13p. Dep. NTIS $4.00.

The count rate from an epithermal neutron log was compared to the volume percent water obtained from many borehole samples taken from Yucca Flat at the Nevada Test Site. Over a limited range of bulk density and water content, it appears possible to fit a reasonable calibration curve to core samples from the southern part of Yucca Flat. For the northern part, where bulk density varies over a considerably larger range, and only sidewall samples are generally available, no acceptable calibration curve seems possible. (auth)

9645 DEVICE FOR THE DETERMINATION OF THE CONCENTRATION OF A GAS COMPONENT IN A BINARY GAS MIXTURE. Ehrfeld, W.; Bley, P. (to Gesellschaft fuer Kernforschung mbH). German (FRG) Patent 2,124,626. 10 Jan 1974. 4p. (In German).

The patent claim concerns a device for the analysis of a mixture of two gases with different ionization cross sections. The gas mixture flows through a measuring cell which contains a calibration gas in a closed subsection. The ionization streams of the gases (gas mixture as well as calibration gas) ionized by virtue of an alpha-particle source are measured using two ionization detectors. At the same time the pressure of the gas mixture is measured, which is transferred to the calibration gas by means of a membrane. Even the temperature is transferred in the same way, which can be measured and used for the pressure calculation. (GE)

9646 CALIBRATION CONTAINER FOR RADIOMETRIC DENSIMETER. Novakova, O.; Smola, J. Czech Patent 146,072. 15 Nov 1972. 3p. (In Czech).

A calibration container is proposed for a radiometric densimeter. It consists of a cylinder made of a homogeneous material having a density of 0.8 to 1.1 g/cm^3 (e.g., paraffin, polyethylene, etc.) and of a central guide tube for the calibrated probe placed in a bore along the cylinder axis. In the active region of the container, 8 channels are symmetrically arranged around the central guide tube. The channels serve the insertion of bars made of materials with a density exceeding 6 g/cm^3 (e.g., lead). (INIS)

9647 METHOD AND APPARATUS FOR RADIOACTIVE WELL LOGGING. Caldwell, R. L. (to Mobil Oil Corp.). US Patent 3,800,145. 26 Mar 1974. Filed date 19 May 1972. 8p.

A neutron source for use in radioactive well logging and logging methods employing such source are described. The source comprises emitter and target components which are movable relative to one another. Both components may take the form of concentrically disposed inner and outer casings or sleeves. Each component includes a plurality of laterally spaced surfaces with those of the emitter component containing an emitter material and those of the target component containing a target material which is characterized by the emission of primary radiation in response to exposure to radiation from the emitter material. Means are provided for moving the emitter and target components to an active position in which complementing surfaces are adjacent to one another to provide for the emission of primary radiation and an inactive position in which the surfaces are displaced longitudinally from one another. (Official Gazette)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstracts 9459 and 9461.

9648 (N-73-32554) EFFECTS OF NUCLEAR RADIATION ON A HIGH-RELIABILITY SILICON POWER DIODE. 4. Analysis of Reverse Bias Characteristics. Been, J. F. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Oct 1973. 36p. (NASA-TN-D-7423; E-7362). NTIS $3.00.

The effects of nuclear radiation on the reverse bias electrical characteristics of 100 silicon power diodes were investigated. On a percentage basis, the changes in reverse currents were large but, due to very low initial values, this electrical characteristic was not the limiting factor in use of these diodes. These changes were interpreted in terms of decreasing minority carrier lifetimes as related to generation-recombination currents. The magnitudes of reverse voltage breakdown were unaffected by irradiation. (auth)

9649 (NIIAR-P-184) PERFORMANCE TESTING OF DKM6 ELECTRIC MOTOR UNDER IRRADIATION. Aseev, N. A.; Losev, N. P.; Samsonov, B. V.; Tsykanov, V. A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Melekess (USSR)). 1973. 36p. (In Russian). INIS.

In spite of the wide use of electrical equipment in atomic installations, there are only a small number of studies on the operability of the equipment in high radiation fluxes. The available data on the operation of assemblies up to integral doses of 10^{12} to 10^{15} n/cm^2 cannot be extrapolated to higher integral doses. This gap can be partially explained by the fact that ordinarily electrical equipment is not placed in a zone of significant radiation. However at present it is becoming necessary to install electrical equipment in zones having a high radiation level. Results are presented on tests of the DKM-6 motor in fluxes of mixed radiation of different intensity. The electrical characteristics of the motor were measured. It is shown that integral doses of 4.6×10^{17} n/cm^2 for fast neutrons, 5.5×10^{18} n/cm^2 for thermal neutrons and 5×10^{10} rads for gamma radiation are close to the maximum allowable for motors of this construction. (SJR)

9650 (ORNL-4899) EFFECTS OF ELECTROMAGNETIC PULSE (EMP) ON THE SUPERVISORY CONTROL EQUIPMENT OF A POWER SYSTEM. Final Report. Baird, J. K.; Frigo, N. J. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. 141p. Dep. NTIS $5.45.

This study assesses the damage caused by EMP to relays and other equipment forming the supervisory control circuits of a power system. Electromechanical relays are nearly impervious to damage and false operation due to EMP. Semiconductor relays are expected to be quite sensitive to both. Countermeasures are proposed to limit damage and prevent false operation of supervisory control circuits. (auth)

9651 (SLA-74-5243) DESIGN REQUIREMENTS FOR RADIATION HARDENED SEMICONDUCTOR DEVICES. Gregory, B. L.; Gwyn, C. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 2p. (CONF-740612-3). Dep. NTIS $4.00.

From government microcircuit applications conference; Boulder, Colorado, USA (25 Jun 1974).

The radiation failure mechanisms in semiconductor devices are outlined, and displacement damage effects and ionization effects are reviewed. (WHK)

9652 (SLL-74-5223) ELECTRICAL EQUIVALENCE OF TWO DIFFERENT RADIATION-INSENSITIVE CABLE DESIGNS. Marx, K. D.; Williams, E. O. (Sandia Labs., Livermore, Calif. (USA)). Mar 1974. Contract AT(29-1)-789. 13p. (CONF-740707-7). Dep. NTIS $4.00.

From annual conference on nuclear and space radiation effects; Fort Collins, Colorado, USA (15 Jul 1974).

Flat coaxial cables which are very insensitive to radiation were studied. It is shown that the outer conductor of the flat coax need not form a complete Faraday shield to obtain the desired properties. It was found that the 3-conductor stripline is essentially equivalent to the flat coax if the outer conductors are interconnected only at the line ends. (WHK)

9653 SPACE RADIATION DAMAGE MEASUREMENTS IN THE EARTH SYNCHRONOUS ORBIT. Sarles, F. W. Jr.; Stanley, A. G.; Roberge, J. K.; Godfrey, B. W. (Massachusetts Inst. of Tech., Lexington). IEEE (Inst. Elec. Electron. Eng.), Trans. Aerospace; AES-9: 921-924(Nov 1973).

Problems connected with the direct measurement of the radiation damage to which satellites are exposed in the earth synchronous orbit are considered. A neutron dosimeter consisting of a p-i-n silicon diode with a lifetime of 100 microseconds in the intrinsic region was developed to overcome these problems. A space experiment conducted in connection with the development of the new device is discussed together with electron irradiation measurements, approaches of data reduction, and aspects of radiation damage in earth synchronous orbit. (IAA)

Miscellaneous Instruments

Refer also to abstracts 9055, 10491, and 11586.

9654 (BARC/I-217) DATA DISPLAY SYSTEM FOR FOUR PARAMETER DATA ACQUISITION SYSTEM. Ballal, B. R.; Mataria, S. K.; Rama Rao, P. N.; Raote, S. L. (Bhabha Atomic Research Centre, Bombay (India)). 1972. 6p. INIS.

A one parameter display system for the data recorded by the four parameter data acquisition system was fabricated. It consists of an interface coupling magnetic tape reader and multichannel analyzer. With this system the single spectrum of any one of the parameters recorded on the magnetic tape by the multiparameter system can be displayed. This display is essential for calibration and for monitoring the stability of each parameter. The working of the interface unit and the operating procedure are described. (auth)

9655 (CEA-N-1686) RELIABILITY OF SOME DATA HANDLING ELECTRONIC EQUIPMENT MANUFACTURED BY INTERTECHNIQUE. Gache, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1973. 9p. (In French). Dep. NTIS (US Sales Only) $4.00.

A short analysis is made of the reliability of different nuclear data handling equipment in use for many years in the research laboratories of the CEA. The equipment dealt with are analyzers and data handling units manufactured by INTERTECHNIQUE, for which the equipment X hours cumulated is important. The results show a constant increase of the MTBF of the majority of equipment; it can also be noticed that the wearout period is not attained for equipment whose mean age is 8 years old. A comparison is made of the reliability of equivalent systems of two different technologies (transistors and integrated circuits); the mean time between failures observed for the integrated circuits is double that of the transistorized equipment. (FR)

9656 (IFVE-SEF-72-99) SCALER DECADE ON INTEGRATED CIRCUITS WITH 100 MHz NOMINAL COUNTING RATE. Rodnov, Yu. V.; Rybakov, V. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 10p. (In Russian). INIS.

A scaler decade is described with integrated circuits and a maximum counting rate of 100 MHz. The decade assembly contains control elements, an indicating circuit, circuits for readout onto a register and an internal generator. The scaler decade may be used in the standard converting device IFVE along with an inlet unit in order to increase the fast response of the scaler equipment and its capacity. (SJR)

9657 (IFVE-SEF-73-13) SCALER SYSTEM ON INTEGRATED MICROCIRCUITS. Dunaitsev, A. F.; Rodnov, Yu. V.; Sytin, A. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 24p. (In Russian). INIS.

A scaler system is described that consists of 24 converting circuits each with a capacity of 10^7 and of assemblies for readout of information to a digital register. The maximum count rate of the scaling circuits is not less than 30 megahertz. The system was constructed with extensive use of integral microcircuits. The system is intended for counting negative pulses from nanosecond electronic equipment in use at present at IHEP. (SJR)

9658 (N-73-25879) REMOTE ANALYSIS OF PLANETARY SOILS: X-RAY DIFFRACTOMETER DEVELOPMENT. Final Report. Gregory, J. C. (Alabama Univ., Huntsville (USA). School of Graduate Studies and Research). Apr 1973. Contract NAS8-27336. 40p. (NASA-CR-124271). NTIS $4.00.

A system is described suitable for remote low power mineralogical analysis of lunar, planetary, or asteroid soils. It includes an x-ray diffractometer, fluorescence spectrometer, and sample preparation system. A one Curie ^{55}Fe source provides a monochromatic x-ray beam of 5.9 keV. Seeman-Bohlin or focusing geometry is employed in the camera, allowing peak detection to proceed simultaneously at all angles and obviating the need for moving parts. The detector system is an array of 500 to 600 proportional counters with a wire-spacing of 1 mm. An electronics unit comprising preamplifier, postamplifier, window discriminators, and storage flipflops requiring only 3.5 milliwatts was designed and tested. Total instrument power is less than 5 watts. Powder diffraction patterns using a flat breadboard multiwire counter were recorded. (auth)

9659 (RISO-M-1705) DIRECT COMPUTATION ON THE KINETIC SPECTROPHOTOMETRY. Hansen, J. W.; Pedersen, P. B. (Danish Atomic Energy Commission, Risoe. Research Establishment). Mar 1974. 31p. Dep. NTIS (US Sales Only) $4.75.

An analog computer designed for calculations of transient absorption from photographed recordings of the oscilloscope trace of the transmitted light intensity is described. The computer calculates the optical density OD, the natural logarithm of OD, and the natural logarithm of the difference between the limiting optical density OD_∞ and the actual optical density, and the reciprocal of the optical density. The calculated values are displayed on a digital voltmeter or recorded on an XY-recorder. Accuracy and linearity of the individual computing circuits are discussed, and the overall performance of the system is demonstrated. In the appendices a user's manual is given. The computer was especially developed for analyzing oscilloscope photos from electron pulse radiolysis. (auth)

9660 (UCID-16485) DEVELOPMENT OF EQUIPMENT FOR HIGH TEMPERATURE RESISTIVITY MEASUREMENTS. Slivinsky, S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 May 1974. Contract W-7405-eng-48. 22p. Dep. NTIS $4.25.

Apparatus has been developed to measure resistivity accurately as a function of temperature at high temperatures for metals and alloys. The resistivity of 0.254-mm dia tantalum wire was measured between the temperatures of 1165°K ± 7°K and 2862°K ± 23°K. Temperatures were measured with an automatic optical pyrometer, a two-color ratio pyrometer, and a tungsten-rhenium thermocouple. The temperature observations were made under simulated blackbody conditions. The good agreement with data from other experimenters indicates that the apparatus performs satisfactorily. (auth)

9661 (UCID-30073) COMPUTER-CONTROLLED APPARATUS FOR PERMEABILITY MEASUREMENTS AT CONFINING PRESSURES UP TO 10^8 PASCAL (10^3 BAR). Quong, R.; Baker, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 May 1974. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

A computer-controlled apparatus for determining the permeability of porous media via the measurement of gas flow is described. Measurements are made in the Darcy-flow regime in small, cylindrical rock samples at confining pressures up to 10^8 pascal (15,000 psi) and at water saturations up to 60%. This enables the permeability to be measured at conditions similar to those in a rock formation. Data acquisition is greatly facilitated through use of a time-shared PDP-9 computer, programmed to control equipment operation and to reduce the accumulated data. (auth)

9662 (ZFK-261) REPORT ON THE 2nd INTERNATIONAL SEMINAR ON NUCLEAR STRUCTURE PHYSICS AND DATA

PROCESSING, GAUSSIG, GERMANY, DECEMBER 11–15, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Aug 1973. 98p. (In German). (CONF-721235-).

This report includes most of the lectures given in the 2nd International Seminar on Nuclear Structure Physics and Data Processing, which was held in Gaussig, December 11–15, 1972, and which was organized by the Section for Physics at the Technical University, Dresden. The seminar dealt with the following problems: application of small computers in physical experiments, interface for coupling measuring apparatus to the computer, modular programming for analysis of neutron spectra, man–computer dialog, comparison of the modern programming languages PL/I and ALGOL 68, nonequilibrium processes in neutron reactions, and intermediate resonances and nuclear photo processes. (auth)

9663 DESIGN, CONSTRUCTION, AND OPERATION OF A MASS SPECTROMETER FOR URANIUM ISOTOPE RATIOS. Casar Aldrete, M. I. Mexico City; Universidad Nacional Autonoma de Mexico (1973). 97p. (In Spanish).

Thesis.

The mass spectrometer of the Institute of Physics in Mexico, designed for the isotopic analysis of uranium, is described in detail. The ion optics, ion source, analyzing systems, and detection systems are considered. The data acquisition and the correction methods are also described. Methods of improving the system are indicated. (JSR)

9664 NEUTRON FLASH PHOTOGRAPHY WITH FAST NEUTRONS. Mourad, S.; Jager, E. H.; Thomanek, F. R. (Messerschmitt-Boelkow-Blohm GmbH, Schrobenhausen, Ger.). Atomwirt., Atomtech.; 19: No. 1, 29-30(Jan 1974). (In German).

The nature of the radiation of neutrons, due to the diffraction and absorption, enables the investigation of material, where the methods used are similar to those in the x-ray technique. The short-time photography, developed in ballistics, with visible x-radiation renders fast moving objects and fast processes visible. Thus, one has tried to obtain the additional information from the pulsed neutron radiation, i.e., to make use of neutron flash photography. Flash sources of sufficient intensity with slow neutrons are not available today. Contrary to this, one disposes of the plasma focus as a flash source of fast neutrons. Examinations relating to the required neutron density for producing images showed that the neutron density per discharge is achieved today by a large plasma focus working with deuterium which may lead to the realization of neutron flash photography. (GE)

9665 BLAST-ACTUATED CONTROL SYSTEM. Pferd, W.; Witt, E. F. (to Bell Telephone Labs., Inc.). US Patent 3,810,141. 7 May 1974. Filed Date 20 Dec 1971. 6p.

A blast-actuated control system for operatively controlling an alarm circuit in response to shock wave pressure resulting from a nuclear explosion which produces a sudden high rise in the temperature and the pressure of air surrounding the system is described. The control system comprises a housing having a chamber containing a switch actuator and a flat plate. The plate is loosely supported inside the chamber and is adapted for being raised upward for operating the switch actuator in response to the sudden increase in air pressure that is produced by a nuclear blast. Although the blast also produces a sudden high rise in temperature which causes expansion of both the housing and the plate, this expansion will not impede the movement of the plate because of its loose supporting construction. (Official Gazette)

9666 DETERMINATION OF LAYER THICKNESS OF GALVANIC ZINC AND SILVER COATINGS BY β REFLECTION. Pazmandi, L. (Magyar Tudomanyos Akademia Isotop Intezete, Budapest); Tabor, P.; Varaljai, M.; Zold, E. Izotoptechnika; 17: No. 3, 155-171(Mar 1974). (In Hungarian).

The theoretical principles; development, calibration, and application of thickness gages are presented. (auth)

9667 SOME FEATURES OF MASS SPECTROMETER FOR INVESTIGATION OF NEUTRAL AND IONIC SPECIES VAPORIZED FROM HIGH TEMPERATURE SURFACE. Sasaki, N.; Kubo, K.; Asano, M. Tech. Rep. Inst. At. Energy, Kyoto Univ.; No. 163, 1-9(Jan 1974).

A specially improved mass spectrometer has been used in a series of studies on the Langmuir vaporization and the surface ionization of some carbides heated on graphite filaments. Some features of the mass spectrometer are described, particular attention being given to a description of newly developed ion source. The ion source is constructed by the combination of an electron impact source with a surface ionization source for the purpose of the detection of both neutral vapor species and thermal ion species. Even at high temperatures, the insulation of the surface ionization source is fully maintained by the use of molybdenum thick plates and alumina or boron nitride plates and cylinders. (auth)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstracts 9055, 10568, and 11483.

9668 ISOTOPIC SEPARATION BY A MIXED VAPOR, ADSORBATE, AND CONDENSATE FLOW. Lallemand, A.; Eyraud, C. (Univ., Lyon). Bull. Soc. Fr. Ceram.; No. 100, 31-38(Jul 1973). (In French).

Experimental studies of the isotopic separation of an adsorbable vapor by diffusion through a microporous wall were conducted for relative pressures varying between zero and one. They demonstrated that for a fractional coverage of less than 0.6, the adsorbed phase separation factor is identical to that of the gas phase. The flow of a multimolecular thickness of adsorbate has a separative effect dependent on the fractional coverage. The separation factor is equal to that of the gas phase for low fractional coverages and tends to zero as the coverage increases. The flux of the capilliary condensate is accompanied by an enrichment in the heaviest isotope downstream from the microporous material. There is, therefore, an inversion of the separative effect in relation to the gaseous diffusion case. (FR)

9669 URANIUM ENRICHMENT: SUPPLY, DEMAND, AND COSTS. Roberts, J. T. Int. At. Energy Agency Bull.; 16: No. 1/2, 94-104(1974).

Data are presented on separative work requirements assuming low and high limits to nuclear power growth to the year 1990; past and current enrichment costs; and future enrichment costs using gaseous diffusion and gas centrifuge plants. (LCL)

9670 URENCO'S STRATEGY IN COMMERCIAL URANIUM ENRICHMENT. Bergh, T. P. van den. Atoomenerg. Haar Toepass.; 16: No. 3, 67(Mar 1974).

Two tripartite international companies, Centec and Urenco, were established as a result of the Almelo Agreement. The functions of Centec are to undertake research and development and to build centrifuge uranium enrichment plants. Urenco is responsible for operating the plants and for marketing their products. Progress in both the technical and commercial fields is reported. (NL)

9671 ULTRACENTRIFUGES FOR THE ENRICHMENT OF URANIUM. Rippon, S. (Nuclear Engineering International, London). Energ. Nucl. (Madrid); 19: No. 87, 15-20(1974). (In Spanish).

A brief historical review is presented of the development of ultracentrifuges for the enrichment of uranium with emphasis on the characteristics of construction materials. An economic evaluation is made of the method. Commercial installations presently in operation or now under construction are described. (tr-auth)

Isotopic Power Sources

9672 (MLM-2106) LES 8/9 VIBRATION TEST ON A MULTIHUNDRED WATT FSA. Anderson, C. G.; Brewer, C. O. (Mound Lab., Miamisburg, Ohio (USA)). 2 May 1974. Contract AT(33-1)-Gen-53. 91p. Dep. NTIS $7.75.

A random vibration test was performed on a $^{238}PuO_2$ fueled Multihundred Watt (MHW) fuel sphere assembly (FSA). The FSA (MHFT-11) was mounted in a Mound Laboratory test fixture and subjected to sinusoidal and random vibration energies on three orthogonal axes while in a simulated operational condition. The FSA temperature was maintained at 1000°C during the vibration test. Visual and radiographic inspections subsequent to the test indicated no apparent degradation of the FSA. (auth)

Radiation Sources

Refer also to abstracts 9605, 11356, and 11907.

9673 (AAEC/E-306) PRODUCTION OF YTTERBIUM-169 RADIOGRAPHY SOURCES IN A HIGH FLUX REACTOR. Hetherington, E. L. R.; Wood, N. R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Feb 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

The irradiation of ytterbium-168 in the Hollow Fuel Element facilities of the AAEC research reactor HIFAR was studied to determine the optimum conditions for the production of ytterbium-169 for industrial radiography sources. The thermal neutron activation cross-section of ytterbium-168 is 3,470 barns; in core positions in the reactor this is significantly increased by the contribution of epithermal neutron activation. Flux depression and target burnup are such that the activation formula normally used for radioisotope production calculations is inadequate. Therefore, a modified formula which includes corrections for these effects, combined with iterative computer calculations to correct for effects resulting from the change in target mass during irradiation, was used to calculate ytterbium-169 yields. (auth)

9674 (BARC-737) PROGRESS REPORT OF THE ISOTOPE DIVISION FOR THE PERIOD ENDING DECEMBER 1973. Jayaraman, S.; Iya, V. K. (eds.). (Bhabha Atomic Research Centre, Bombay (India)). 1974. 278p. Dep NTIS (US Sales Only) $17.00.

Development of chemical processes for radioisotope production and of uses of radioisotopes in industry and hydrology in India during 1973 are reviewed. Information is included on: radiopharmaceuticals; radiochemicals; ^{14}C and tritium labeled compounds; radiosterilization of medical products; radiopolymerization; industrial radiography using radioisotope sources; uses of radioisotopes in hydrology; industrial tracer techniques and radiation instruments; training of personnel for using radioisotopes; and sales of radioisotopes. (LCL)

Design and Fabrication

Refer also to abstract 9647.

9675 SEAL OF RADIOISOTOPE SOURCE FOR MATERIALS IRRADIATION. Nemec, J.; Skaba, Z. Czech Patent 146,506. 15 Dec 1972. 3p. (In Czech).

A seal is proposed for a radioisotope source for irradiation of materials. The seal is of a simple design and safeguards the protection of personnel against harmful effects of radiation. Radiation is shielded down to a permissible limit by a spherical shielding material. Through the center of the sphere, a motion screw passes of absorbing material, such as stainless steel. The diameter of the seal is equivalent to the thickness of the absorbing mass. Leaks resulting from the passage of radiation through tolerances between the threads of the motion screw and the nut are eliminated by scattering following multiple reflection, at a wide angle, on the thread surfaces, and by the screw diameter which exceeds the diameter of the cavity and of the case in which the radioisotope is housed. The motion screw is mechanically driven by a program-controlled drive or by an emergency drive used in case of a power outage. (INIS)

9676 NEW TYPE OF IRIDIUM-192 RADIOACTIVE WIRE SOURCE FOR INTERSTITIAL RADIOTHERAPY. Mihailov, M. (Inst. for Nuclear Research and Nuclear Energy, Sofia); Sahatchiev, A.; Mazhkarov, S.; Moushmov, M.; Mutafchiev, K. Isotopenpraxis; 10: No. 1, 18-20(Jan 1974).

The technique for the production of radioactive iridium-192 wires and hairpins with a gradually increasing specific linear activity towards the ends is described. It consists of irradiation of the nonradioactive iridium-platinum wires covered with a 0.1 mm platinum filter with a neutron flux through a special prepared cadmium screen. The isodose curves around these wires have a course coaxial to the wire axis. In this way, the necessity of crossing the ends of the implant is avoided and a better dose distribution is achieved. The dose to the operator and the staff is diminished. (auth)

Industrial Uses

Refer also to abstracts 9727, 9733, 9734, 9750–9755, 9781, 9789, and 10569.

9677 (SGAE-2253) INACTIVE TRACER TECHNIQUE FOR DETERMINATION OF THE EFFICIENCY OF AN EVAPORATOR PLANT FOR RADIOACTIVE WASTE WATER. Huber, I.; Benischek, F. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf, Inst. fuer Isotopenanwendung). Mar 1974. 15p. (In German). Dep. NTIS (US Sales Only) $4.00.

A rapid and accurate tracer technique to determine the decontamination factors of an evaporator plant is described. The measurement of the tracer elements were performed on an atomic absorption spectrophotometer. By use of the heated graphite atomizer, decontamination factors of 10^3 to 10^5 can be determined

as well as the decontamination factors of a stock solution with very little salt content. The accuracy of the method was checked by parallel labeling with several tracers. (auth)

9678 GENERATORS FOR THE PRODUCTION OF SHORT-LIVED NUCLIDES TO BE USED FOR THE INVESTIGATION OF MATTER TRANSPORT PROCESSES IN INDUSTRIAL PLANTS. Runge, K.; Grahl, G. (Technische Univ., Dresden). Isotopenpraxis; 10: No. 4, 133-137(Apr 1974). (In German).

The use of short-lived radionuclides from generator systems offers advantages with regard to the investigation of matter transport processes and mixing processes in pilot and industrial plants. However, this implies meeting of demands with regard to radiation energy which cannot be met by commercial generator systems used in nuclear medicine. Therefore, the $^{140}Ba/^{140}La$ generator system has been developed and successfully tested to be used for the investigation of matter transport processes in continuously operating polycondensation reactors. (auth)

9679 EXPERIMENTAL IRRADIATION FACILITY FOR THE STERILIZATION OF SEWAGE SLUDGE. Suess, A. (Bayrische Landesanstalt fuer Bodenkultur, Pflanzenbau, und Pflanzenschutz, Munich); Schurmann, G.; Bosshard, E.; Luescher, O.; Moetsch, H. Kerntechnik; 16: No. 2, 65-70(Feb 1974). (In German and English).

The new sewage sludge sterilization facility, equipped for the time being with a 120 kCi ^{60}Co source, promises to be very useful and represents an important contribution of radiation engineering to environment protection. It will make it possible to carry out hygienic, technical and economic studies on an industrial scale, required for assessing this sterilization method in connection with the utilization in agriculture of the ever increasing quantities of sewage sludges. (GE)

9680 METHOD OF DETECTING AIRCRAFT FUEL LINE LEAKS WITH RADIOACTIVE GAS TRACERS. Fries, B. A. (to Chevron Research Co.). US Patent 3,809,898. 7 May 1974. Filed date 4 Aug 1971. 6p.

A method of detecting aircraft fuel line leaks by dissolving trace amounts of a radioactive gas such as krypton-85, tritium, etc., in the fuel and measuring the level of radioactive emanations along the fuel system is described. An increase in the intensity of such emanations is noted in the vicinity of the leak. (Official Gazette)

9681 PRESENT STATUS OF INDUSTRIAL APPLICATIONS OF RADIOISOTOPES AND RADIATION. Sato, O. (Mueszaki Tudomanyok Intezete, Tokyo); Kobayashi, M.; Enomoto, S. (Tudomanyegyetem Muszaki Tudomanyok Intezete, Tokyo). Izotoptechnika; 17: No. 3, 130-139(Mar 1974). (In Hungarian).

Industrial uses of radioisotopes and radiation in Japan are reviewed. (TFD)

9682 APPLICATION OF RADIOISOTOPES AND RADIATION IN THE FIELD OF AGRICULTURAL ENGINEERING. Ochiai, T. (Orszagos Agrotechnikai Kutatointezet, Budapest). Izotoptechnika; 17: No. 3, 140-146(Mar 1974). (In Hungarian)

Agricultural uses of radioisotopes and radiation in Japan are reviewed. (TFD)

9683 FIBER REINFORCED PLASTICS. Araki, K. (Japan Atomic Energy Research Inst., Takasaki); Sasaki, T.; Goto, K. Kogyo Zairyo; 21: No. 9, 23-27(Sep 1973). (In Japanese)

Research on the continuous radiation hardening of a thick plate of fiber-reinforced plastics is described. The functional research for the selection and improvement of irradiation procedures, forming and molding techniques, and physical properties of resins has been pursued since 1967. As a result of testing an unsaturated polyester resin, a radiation dose of not less than 6 Mrad at 1 mA of electron beam or not less than 1 Mrad with the gamma-ray from ^{60}Co source are required for the hardening effect. Actual irradiation time is about 1.5 minutes in case of 10 Mrad at 1 mA with the 2-MeV electron accelerator. In addition, reaction efficiency is approximately 100%. Parallel light transmission, weathering resistivity, bending strength, Young's modulus, dielectric characteristics, insulation resistance, volume specific resistance, etc. were measured. The continuous hardening process for producing a thick FRP plate have been carried out with an automatic apparatus which comprises feeding, impregnation, debubbling, irradiation, pulling and cutting sections. With a 3-MeV Cockcroft-Walton type accelerator and operating conditions of 2.5 MeV, 4 mA, and hardening speed of 3 m/min (2 Mrad), a FRP plate of 4.5 cm thick was produced. (JA)

9684 APPLICATIONS OF RADIOTRACERS TO INDUSTRIAL PROCESSES. Aranda, G. R. Veracruz, Mexico; Instituto Tecnologico Regional de Veracruz (1973). 72p. (In Spanish).

Thesis.

The nature of radioactivity, its detection, and protection from it are reviewed. The characteristics of radiotracers are outlined. Typical problems found in industry that can be resolved by the use of radioisotopes are discussed. Techniques for the experimental determination of the average residence time of liquids in containers are described as an illustration of the industrial application of radioisotopes. The design of an ideal chemical reactor and the factors affecting it are discussed. An economic analysis is made of the industrial use of radiotracers and it is concluded that at the present time many of these techniques are costly for the present industrial development of Mexico but that as the country develops industrially their use will become economically feasible. (tr-auth)

9685 PHYSICAL ASPECTS OF INDUSTRIAL-SCALE IRRADIATORS FOR THE STERILIZATION OF MEDICAL AND PHARMACEUTICAL PRODUCTS. Velazquez Saavedra, J. J. Mexico City; Universidad Nacional Autonoma de Mexico (1974). 216p. (In Spanish).

Thesis.

The physical aspects of industrial-scale irradiation facilities are considered in detail. The interaction of electrons, γ rays, and x rays with matter is first described. The attenuation of radiation and absorption coefficients are discussed. Gamma sources and electron accelerators are described. The basic dosimetry concepts are given. The characteristics of several industrial irradiation facilities are reviewed. Experimentally the variation of the dose rate as a function of the position within a container and as a function of the material density was determined. (JSR)

9686 RADIOGRAPHIC ANALYSIS FOR THE DETECTION OF INTERNAL INFESTATION OF CORN GRAINS. Walkup, G. C. Mexico City; Universidad Nacional Autonoma de Mexico (1974). 194p. (In Spanish).

Thesis.

A study was made to determine the optimum conditions for the disinfestation and preservation of corn irradiated with electrons. Within the framework of this study an x-ray radiographic technique was developed to determine the internal infestation of corn by insects. With this method it is possible to determine and identify the various stages of development of the insects in the grain. A detailed description is given of the x-ray equipment used. (JSR)

9687 USE OF RADIOISOTOPES IN JAPAN. Foldiak, G. (Magyar Tudomanyos Akademia Isotop Intezete, Budapest). Izotoptechnika; 17: No. 3, 113-118(Mar 1974). (In Hungarian).

General data on the use of radioisotopes in Japan are given. (auth)

9688 EATABILITY TESTS OF IRRADIATED FOODS. I. A. Initial Test in Birds of the Eatability of Irradiated Fish Meal. de la Sierra Serrano, D.; Casas Medina, F. Energ. Nucl. (Madrid); 19: No. 87, 29-39(1974). (In Spanish).

The standards followed to test the innocuity of irradiated foods using biological tests on laboratory animals are described. In the studies made with birds, the hematological, enzymatic, and microbiological tests used to detect possible variations in the animals fed with fish meal irradiated at different doses are indicated. The results obtained are discussed. (tr-auth)

LIFE SCIENCES

9689 RADIATION DAMAGE ASSESSMENT FROM ELECTRON IMAGES USING DIGITAL CORRELATION METHODS. Frank, J. (Cambridge Univ., Eng.). J. Phys., D (London); 7: No. 7, L75-L78(1 May 1974).

Radiation damage of biological specimens in the transmission electron microscope is commonly investigated by electron diffraction. Since this method has several drawbacks, it is proposed that additional information should be used by computer evaluation of successive images taken under conditions of low exposure. A measure of dissimilarity and a radial distribution function in Fourier space are defined, which can be used to characterize the history of structural changes caused by radiation damage in a way that is independent of the particular features of the object. (auth)

9690 EFFECT OF CERTAIN COSMIC AND GEOPHYSICAL FACTORS ON THE EARTH'S BIOSPHERE. Kholodov, Yu. A. (ed.). Probl. Kosm. Biol.; 18: 210(1973). (In Russian).

Papers dealing with the biological effects of solar radiation and magnetic fields are included, covering the biosphere, mental and social effects, occurrences of epidemics, plant and bacterial life, and responses of man and animals to magnetic fields and solar activity. The relation between the geomagnetic field and solar radiation on the one hand and life on earth, on the other, is also studied. (IAA)

Radiation Effects on Biochemicals

Refer also to abstracts 9184, 9207, 12140, 12142, and 12144.

9691 (N-71-37633) ULTRAVIOLET LIGHT AND THE ORIGIN OF RIBOSOMES. Sagan, C.; Shapshak, P. (Cornell Univ., Ithaca, N. Y. (USA). Lab. for Planetary Studies). May 1971. 13p. (NASA-CR-123164; CRSR-446). NTIS.

The complex chemical changes in nucleopeptides giving rise to contemporary ribosomes are discussed. Possible mechanisms used for the synthesis of these interactions are discussed along with the possible effects of uv light on the complex evolutionary processes involved in the interactions. (STAR)

9692 (ORO-2690-14) RESEARCH PROPOSAL AND ANNUAL REPORT No. 14, SEPTEMBER 1, 1973–AUGUST 31, 1974. Part B. (Florida State Univ., Tallahassee (USA). Inst. of Molecular Biophysics). 1 Jun 1974. 76p. Dep. NTIS $7.00.

Research programs on molecular biophysics are reviewed. Studies reported in progress include: enzyme kinetics and mechanisms of action; the effects of external and internal irradiation on the proliferation of cultured tumor cells; reactions of molecular oxygen in irradiated biological systems; macromolecule contractility; the biochemistry of nucleic acids; the isolation and characterization of molecular subunits of DNA; electronic interactions in helical polymers; studies of collagen analogs; the physical and chemical properties of calf thymus chromatin; the organization, replication, and repair of chromosomes; visual processes; and visual sensory transduction. A list is included of 32 publications during the period covered by this report that present results of studies completed. (CH)

9693 (SGAE-2247) INVESTIGATIONS INTO THE EFFECT OF DIFFERENT FUROCUMARINES ON DNA REPAIR AND SEMICONSERVATIVE DNA SYNTHESIS. Wittauer, G.; Pailer, M.; Altmann, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Feb 1974. 14p. (In German). (CONF-731215-3). Dep. NTIS (US Sales Only) $4.00.

From international symposium on DNA-repair and late effects; Vienna, Austria (6 Dec 1973).

Three structurally different furocumarines were tested on their ability to inhibit semiconservative DNA-synthesis and DNA-repair in mouse spleen cells. After uv-irradiation (254 nm), Xanthotoxin (8-methoxypsoralen) and Pimpinellin (5,6-dimethoxyangelicin), in the presence of hydroxyurea, cause an increase in the ^{3}H-thymidine incorporation into DNA, whereas with Ostruthol, a psoralen derivative with a long aliphatic side chain in the 5 position, the repair incorporation is slightly decreased. Following γ-irradiation all three substances inhibit DNA-repair, with Ostruthol producing the strongest effect. Semiconservative DNA-synthesis is also inhibited to varying degrees by the three compounds. (tr-auth)

9694 (SGAE-2261) INFLUENCE OF INDOMETACIN ON SEMICONSERVATIVE DNA SYNTHESIS AND DNA REPAIR. Kocsis, F.; Eberl, R.; Altmann, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Mar 1974. 14p. (In German). (CONF-7309106-1). Dep. NTIS (US Sales Only) $4.00.

From international congress on rheumatology; Kyoto, Japan (30 Sep 1973).

DNA repair was studied after damaging cultured tumor cells with uv or γ rays. Only a slight effect was seen after indometacin (5 μg/ml) treatment in vitro (10 μg/ml produced about 20% inhibition). In blood lymphocytes obtained from cancer patients after indometacin therapy no significant effect on DNA repair could be found. Gradient centrifugation studies in alkaline sucrose showed no changes in the sedimentation profile between control and 30 min DNA repair time after preincubation with 5 μg/ml indometacin and damage of cells with 30 krad ^{60}Co γ rays. It was concluded that indometacin in therapeutic doses has no remarkable effect on DNA excision repair. (auth)

9695 ADRENOCHROME AND RELATED COMPOUNDS. Heacock, R. A.; Powell, W. S. (National Research Council of Canada, Halifax). Progr. Med. Chem.; 9: 275-339(Apr 1971).

Adrenochrome and related compounds are discussed under the following headings: aminochrome formation from catecholamines (including radiation induced oxidations); preparative procedures; physical properties; and chemical properties. (ERB)

9696 STABILITY OF AQUEOUS CHLORAMINE-T SOLUTIONS TO HEAT AND ULTRAVIOLET RADIATION. Mahadevappa, D. S.; Anandamurthy, A. S. (Univ. of Mysore, India). Curr. Sci. (India); 43: No. 8, 246-248(20 Apr 1974).

Some preliminary studies were made on aqueous chloramine-T solutions about their thermal stability over the temperature range 50° to 95° and on their photochemical (UV light) at 3660 Å. The thermal instability of chloramine-T solutions at elevated temperatures could be ascribed to the loss of positive chlorine thereby decreasing the iodometric titer. Photochemical decomposition of chloramine-T solutions was found to obey a first order rate law. (ERB)

9697 COMPETITION BETWEEN TETRAMETHYLPIPERIDINOL N-OXYL AND OXYGEN IN EFFECTS ON SINGLE-STRAND BREAKS IN EPISOMAL DNA AND IN KILLING AFTER X-IRRADIATION IN ESCHERICHIA COLI. Johansen, I. (Norwegian Defense Research Establishment, Kjeller). Radiat. Res.; 58: No. 3, 398-408(Jun 1974).

The x-ray sensitivity of E. coli K12 recA under various concentrations of N-oxyls and oxygen was determined from the survival of colony-forming ability. Oxygen sensitized these cells 1.8 times while tetramethylpiperidinol N-oxyl (TMPN) in the absence of oxygen sensitized them 4.6 times. When present together the marked sensitization by TMPN at 5 mM was competitively reversed by oxygen, one oxygen molecule being as effective as 37 molecules of TMPN. When the level of endogenous sulfhydryls was lowered by pretreating the cells with N-ethylmaleimide, 1/4.8 of the concentration of TMPN was sufficient to raise the x-ray sensitivity. The yield of x-ray induced breaks in circular phage λ DNA molecules in λ lysogens was also measured under various experimental conditions. TMPN neither increased the frequency of DNA single-strand breaks under anoxia nor prevented oxygen from promoting breaks in the DNA. These results show that radiation-induced reactive intermediates or transients, presumably free radicals, responsible for lethality and DNA strand breakage have different chemical properties, and consequently must be distinct. (auth)

9698 EFFECTIVENESS OF OXYGEN IN PROMOTING X-RAY-INDUCED SINGLE-STRAND BREAKS IN CIRCULAR PHAGE λ DNA AND KILLING OF RADIATION-SENSITIVE MUTANTS OF ESCHERICHIA COLI. Johansen, I.; Gulbrandsen, R.; Pettersen, R. (Norwegian Defense Research Establishment, Kjeller). Radiat. Res.; 58: No. 3, 384-397(Jun 1974).

The possibility that the radioinduced radicals responsible for cell killing and for DNA strand breakage are different was studied by determining their relative reactivities towards oxygen under physiological conditions. The yield of x-ray-induced DNA single-strand breaks was determined by measuring the breaks in covalently closed circular λ DNA molecules superinfecting lysogenic strains of Escherichia coli K12. In the presence of oxygen the frequency of DNA breakage is four- to fivefold higher than under nitrogen anoxia. The concentration of oxygen that increases DNA breakage to half the maximal level, k, is 0.5 μM and is similar in repair proficient host cells and in cells mutated in the uvrA and/or recA genes. Intermediate levels of DNA strand breakage seen at low concentrations of oxygen are dependent on the concentration of

cellular sulfhydryl compounds. The effectiveness of oxygen under comparable conditions in enhancing the radiation-induced killing of the non-lysogenic bacterial strains was determined. In cell killing k is 8 μM for repair-proficient cells as well as for cells mutated in the uvrA and/or recA genes. The 16-fold higher reactivity of oxygen in DNA breakage than in cell killing strongly suggests that radioinduced reactions of oxygen leading to increased lethality differ from those promoting DNA single-strand breaks. (auth)

9699 ELECTRON SPIN RESONANCE STUDY OF LIQUIDS DURING PHOTOLYSIS. XVII. 3,5-Pyridinedicarboxylic Acid. Zeldes, H.; Livingston, R. (Oak Ridge National Lab., TN). Radiat. Res.; 58: No. 3, 338-348(Jun 1974).

Radicals present during photolysis of solutions of 3,5-pyridinedicarboxylic acid and its anions have been studied by the ESR method near room temperature. Spectra were analyzed to obtain parameters for four radicals resulting from reduction of the parent compounds. Radicals I, II, and III, respectively, result from hydrogen atom attachment to the nitrogen atom of the parent dicarboxylic acid, its monoanion, and its dianion. Radical IV results from hydrogen atom attachment to one of the carbon atoms bonded to the nitrogen atom of the parent dianion. Conditions and mechanisms of formation are discussed. The pK value for $I \rightleftharpoons II + H^+$ is about 3.4 and that for $II \rightleftharpoons III + H^+$ is about 4.3 in aqueous solution. Evidence is given for the switching of the carboxylic acid proton of II between its two equivalent sites. (auth)

9700 ENDONUCLEASE FROM ESCHERICHIA COLI THAT ACTS PREFERENTIALLY ON UV-IRRADIATED DNA AND IS ABSENT FROM THE uvrA AND uvrB MUTANTS. Braun, A.; Grossman, L. (Brandeis Univ., Waltham, MA). Proc. Nat. Acad. Sci. U. S. A.; 71; No. 5, 1838-1842(May 1974).

At least two endonucleolytic activities that preferentially incise ultraviolet (uv)-irradiated DNA exist in extracts of E. coli. These two activities can be separated by phosphocellulose chromatographic fractionation. The subject of this paper is one of these activities, which elutes from phosphocellulose with 0.25 M potassium phosphate, pH 7.5. This endonucleolytic activity specific for uv-irradiated DNA is absent from partially purified extracts of uvrA and uvrB mutants, which are defective in excision of pyrimidine dimers, but is present in normal amounts in the uvrC excision-defective mutant. The enzyme binds very tightly and specifically to uv-irradiated DNA. Binding can be prevented by prior treatment of the irradiated DNA with photoreactivating enzyme. This binding activity is absent in uvrA and uvrB mutants, but present in uvrC and uvrD mutants. (auth)

9701 SELECTIVE PHOTOCHEMICAL ALKYLATION OF PURINES IN DNA. Salomon, J.; Elad, D. (Weizman Inst. of Science, Rehovot, Israel). Biochem. Biophys. Res. Commun.; 58: No. 3, 890-895(4 Jun 1974).

Ultraviolet irradiation of DNA in the presence of 2-propanol and di-tert-butyl peroxide leads to the selective production of 8-α-hydroxy-isopropyladenine and -guanine, while no pyrimidine dimers are formed. (auth)

9702 LONG-LIVED RADIOINDUCED FREE RADICALS IN ANOXIC WET DNA AS STUDIED BY ELECTRON SPIN RESONANCE. Jones, W. B. G.; Brustad, T. (Norsk Hydro, Oslo). pp 257-262 of Radiation Biophysics, Free Radicals. Vol. II. Broda, E. (ed.). Vienna; Wiener Medizinische Akademie (1971).

From first European biophysics congress; Baden, Austria (14 Sep 1971).

A technique is described that permits samples of hydrated anoxic DNA to be exposed at room temperature to a dose of 1 M rad in less than one second, stored at room temperature for predetermined periods of time, and then frozen at liquid nitrogen temperature. The samples were then analyzed at 77°K in an ESR spectrometer. The experiments show that: Radiation-induced radicals in hydrated DNA are remarkably stable at room temperature. About 10% of those radicals which are detected 9 sec after termination of irradiation persisted for more than 2 hours. The number of radicals that persist 5 min after termination of irradiation appear to decay according to second order kinetics. Furthermore, the ESR spectrum of these radicals is found to be nearly identical to that for irradiated powdered thymidylic acid. Preliminary results indicate that immediately after termination of irradiation of the hydrated DNA the contribution to the total radical yield from species differing from those of irradiated powdered thymidylic acid may amount to about 20%. (INIS)

9703 COMPOUNDS OF THE CYSTEINE-CYSTEAMINE GROUP AND THEIR INFLUENCE ON INFECTIVITY, STRAND BREAKS, AND BASE DAMAGE IN GAMMA-IRRADIATED DNA OF COLIPHAGE ΦX-174. Stephan, G.; Hotz, G. (Kernforschungszentrum, Karlsruhe, Ger.). Z. Naturforsch.; 28c: 463-467(1973).

Single- and double-stranded (RF) DNA of page ΦX-174 were ^{60}Co-gamma irradiated. Dependence of radiosensitivity on the concentration of cysteamine and cystamine was measured. Radioresistance of DNA in vivo (phage particles) as well as of DNA in vitro (infectious DNA) increase between 10^{-4} and 10^{-1} M of superprotective agents. The same relationship is observed when the DNA is in the dry and in the wet state. By fractionating radiation damaged RFI and radiation induced RFII by means of sucrose gradient sedimentation it was possible to measure the protective effect of cysteamine on lesions other than strand-breaks. A pronounced radioprotective effect of cysteamine on the production of single-strand breaks in RF-DNA was found (DRF 20). The convenience of the RF system for studying effects of radioprotective agents on the occurrence of different radiation induced lesions is discussed. (auth)

9704 RADIOPROTECTION (UV AND GAMMA RAYS) OF DNA MOLECULE BY INDOLE AND INDOLE-DERIVATIVES. Tomicic, I.; Pieber, M.; Romero, C.; Soto, A.; Toha, J. C. (Univ., Chile, Santiago). Z. Naturforsch.; 28c: 379-385(1973).

The radioprotective ability of L-tryptophan, tryptamine, 3-indoleacetic, and indole (10^{-4} M), on UV and gamma irradiated DNA (10^{-4} M) is studied. UV radioprotection is accomplished in the following order of efficiency: L-Tryptophan and 3-indoleacetic acid > indole and tryptamine. The corresponding DRF measured as absorbancy loss at 260 nm, were: L-Tryptophan and 3-indoleacetic acid around 3 and tryptamine and indole around 1. When absorbancy loss plus changes in the patterns of the absorbancy curve were considered the DRF was: L-Tryptophan 2.53, 3-indoleacetic acid 1.54, indole 1.22 and tryptamine 0.75, respectively. For gamma radiation damage the order of radioprotection found was: Indole, L-tryptophan, and tryptamine > 3-indoleacetic acid. The DRF when comparing the absorbancy loss at 260 nm, were: L-Tryptophan, indole, and tryptamine around 11 and 3-indoleacetic acid around 4. When evaluating total changes in absorbancy the DRF were: Indole and L-tryptophan around 6.5, tryptamine 3.7, and 3-indoleacetic 2.1. These data were correlated with measurement of the degree of molecular interactions of DNA and protectors, studied by: Spectrophotometry, m.p. determinations, circular dichroism and oriented circular dichroism, viscosity, and rate of dialysis. Also data of fluorescence and phosphorescence were considered. For gamma radioprotection a mechanism based in radical trapping, local radical trapping, and partial recovery of radioprotectors is proposed. UV radioprotection is discussed considering: The close interaction of L-tryptophan with DNA which might impede dimer formation, its proton and electron donor ability. A possible (triplet-triplet) energy transfer from excited DNA to indole derivative is discussed on the basis of acetone competition and a dimer excision process considered. (auth)

Radiation Effects on Cells

Refer also to abstracts 9692, 9694, 9773, 9867, 9931, 12107, 12108, 12110, 12123, and 12125.

9705 (AD-769486) EFFECTS OF NEUTRON IRRADIATIONS ON NERVE TISSUE CULTURES. Part I. The Effects of 14-MeV Neutrons on Neural Cell Explants. Final Report, December 1971-December 1972. Mamoon, A.; Ganwiler, B.; Griffith, R. V.; Tobias, C. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1973. Contract F41609-72-R-0003. 16p. (SAM-TR-73-27). NTIS $2.75.

Neural cells in tissue cultures were exposed to 14-MeV neutrons. Following incubation, the neural cell cultures were examined for arrested myelination, stained for glycogen deposits and chromatolysis, and electrophysiologically scored. Myelination decreased with increasing dose, while glycogen deposits and chromatolysis increased. Electrical activity decreased with increasing dose, and that remaining was altered in pattern. These preliminary results suggest that moderate neutron doses at a high dose rate can inflict considerable direct morphologic and electrophysiologic damage to developing nervous system cells, and 14-MeV neutrons at the range of doses used appear to have about twice the effectiveness of x rays in producing the same biologic endpoint. (auth)

9706 (AD-769487) EFFECTS OF NEUTRON IRRADIATIONS ON NERVE TISSUE CULTURES. Part II. Instrumentation for Remote Electrical Recording from Neurons in Culture. Final Report, December 1971-December 1972. Gahwiler, B.; Mamoon, A.; Schimmerling, W.; Tobias, C. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1973. Contract F41609-72-R-0003. 11p. (SAM-TR-73-28). NTIS $2.75.

In preparing to investigate the effects of 14-MeV neutron irradiation of neural cell cultures, a compact device was built to expose and simultaneously record electrical activity of the neural cells. Unique features include a vibration-free table mounting, a homeostatic nutrition flow, and temperature control

during electrical recording from microelectrodes, remote scanning, with movement in increments of less than one micron, with closed-circuit television monitoring, and a laser beam optical system which allows for stimulation of the neurons in response to preselected firing patterns. (auth)

9707 (AEC-tr-7457, pp 56-60) QUANTITATIVE CHARACTERISTICS OF EXPOSURE OF BIOLOGICAL MATERIALS TO SINGLE PULSE, HIGH-LEVEL X RADIATION. Syazhkina, T. V. 1972. Translated from pp 37-39 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Two x ray units were used to irradiate biological objects. A pulsating x ray tube was used to deliver irradiation at the rate of 100 million to one billion R/sec, one pulse constituting 0.6 to 1 msec. A standard x ray unit was used to irradiate objects at the rate of 0.8 R/sec when radiation was delivered for several minutes. Doses as a function of lethal effect were investigated in 139 experiments on 39,500 fruit fly eggs 1.75 ± 0.25 hours old, with pulsating irradiation and conventional x radiation at doses of 9.8 R/sec. One day after exposure of the eggs to doses of 140 to 530 R, the percentage of embryo deaths were recorded. Studies were made of doses as a function of growth of pea roots on the 7th day after exposure of sprouts to different dose levels (up to 60 seedlings per point). The seedlings were exposed to doses of 100 to 1,000 R. The method was also used to investigate the increase in number of cells in human amnion cultures on the 5th day after x irradiation at the rate of 10^3 R/sec and 0.8 R/sec at doses of 100, 200, 400, 800, and 1,000 R. Investigation of destruction of fruit fly eggs related to pulsating and conventional x irradiation at the rate of 0.8 R/sec revealed that instantaneous exposure of the eggs to 150 to 530 R elicited a somewhat greater damaging effect than conventional x rays. More marked distinctions, constituting 15 to 20%, were manifest in the dose range of 150 to 250 R; at lower and higher radiation dose levels, the biological effect was virtually the same. The assumption was made that the intensification of the effect with a high-level single pulse is related to chromosomal damage, increase in instantaneous breaks, and, as a result, increased number of recombinations, as compared to the effect of a dose rate of 0.8 R/sec. Analysis of correlation between dosage and inhibition of pea root growth on the 7th day after exposure to a high-level single pulse and conventional x irradiation in a dosage of 9.8 R/sec lead to the conclusion that there is somewhat greater suppression of growth with instantaneous irradiation in doses of 100, 400, and 700 R. No significant differences in number of cells were observed in human amnion cultures following irradiation at different dose rates. (CH)

9708 (COO-3212-17) THREE YEAR COMPREHENSIVE REPORT. (Health Research, Inc., Albany, N. Y. (USA)). Feb 1974. Contract AT(11-1)-3212. 7p. Dep. NTIS $4.00.

Developments of ENDOR spectroscopy to the point where primary oxidation and reduction products in conjugated molecules can be identified are described. Applications in the analysis of mechanisms involved in radiation injuries of biological materials are suggested. (CH)

9709 (COO-3419-8) STUDIES ON VIRUS-INDUCED CELL FUSION. Progress Report, August 1, 1973–July 31, 1974. Person, S. (Pennsylvania State Univ., University Park (USA). Dept. of Biophysics). 1974. Contract AT(11-1)-3419. 5p. Dep. NTIS $4.00.

Progress is reported on studies of the biological effects produced by tritium β decay in bacteria labeled with cytosine-6-^{3}H, thymidine-6-^{3}H, adenosine-2-^{3}H, or guanosine-8-^{3}H. Reactions leading to lethality or mutation induction and changes in the primary structure of DNA are described. The transmutation effects produced by tritium decay in bacteria are discussed. (CH)

9710 (IAEA-R-764-F) EXPERIMENTAL INVESTIGATIONS ON THE INTERPLAY BETWEEN NATURAL AND ARTIFICIAL RADIATION PROTECTION. Final Report, 1 July 1969–30 June 1972. Revesz, L. (International Atomic Energy Agency, Vienna (Austria)). Jul 1972. 6p. INIS.

Survival parameters of cells irradiated either in presence or absence of oxygen have indicated that cysteamine pretreatment of cells may result in a decrease of lethal radiation damage as well as in enhancement of recovery processes. For reduction of lethal damage, intracellular release by an exchange reaction of low molecular SH-compounds was suggested. The great majority of these compounds proved to be glutathion, an SH-containing natural tripeptide. Further data have indicated that cysteamine interacts with both sulphydryl and disulphide groups of proteins. For the mechanism of action on recovery processes, the data are in agreement with the assumption that cysteamine prolongs the time available for the cells to repair radiation damage and thus recover. Without this cysteamine pretreatment, fixation of radiation damage was found to be extremely rapid. Oxygen was shown to act as a modifying agent to lethal radiation damage and to recovery from sublethal injury. The oxygen dependence of recovery processes was established in several experimental systems using split-dose irradiations. Cysteamine protected DNA against breaks when irradiation was made under oxic but not under anoxic conditions, while the extent of repair was not influenced at all. These data suggest that protection against single strand breaks is probably due to the removal of oxygen present in the system. Methodological experiments have demonstrated that penetration of cell membranes by cysteamine depends largely on the pH of medium. Increased dissociation of cysteamine at more alkaline pH values may facilitate its passage through plasma membranes. (INIS)

9711 (INMAS/NP-5-70) COMBINED EFFECT OF GENETIC AND CYTOPLASMIC DAMAGE ON CELL SURVIVAL AFTER IRRADIATION WITH IONIZING RADIATION. Gupta, P. C. (Institute of Nuclear Medicine and Allied Sciences, Delhi (India)). 1970. 13p. INIS.

A theory of cell survival after irradiation with ionizing radiation was developed, where the cell was assumed to be composed of two compartments namely the nucleus and the cytoplasm with different radiosensitivities. It was postulated that the nucleus consists of "m" different sensitive regions and the cytoplasm of "n" such regions. Mathematical expressions are obtained for probabilities that a cell will be in a state of survival, damaged state or will function with reduced efficiency after taking into account the recovery phenomena. (auth)

9712 EFFECTS OF CAFFEINE AND THEOPHYLLINE ON DNA SYNTHESIS IN UNIRRADIATED AND UV-IRRADIATED MAMMALIAN CELLS. Lehmann, A. R.; Kirk-Bell, S. (Univ. of Sussex, Brighton, Eng.). Mutat. Res.; 26: No. 2, 73-82(Apr 1974).

From symposium on caffeine as an environmental mutagen and the problem of synergistic effects; Uppsala, Sweden (5 Jun 1973).

The effects of caffeine and theophylline on the rate of DNA synthesis and on the size of newly synthesized DNA made in unirradiated and uv-irradiated rodent cell lines were examined. The principal and most dramatic effect exerted by these methylated xanthines was an inhibition, at relatively low doses of the drugs (0.8 to 1.5 mM), of a post-replication repair process in uv-irradiated cells. Gaps left in daughter DNA strands opposite uv-induced pyrimidine dimers in the parental strands, are normally sealed within a few hours after their formation. In the presence of caffeine or theophylline, this gap-filling process was specifically and strongly inhibited. As a consequence, in uv-irradiated cells low molecular weight pieces of newly synthesized DNA accumulated in the presence of caffeine or theophylline, whereas in their absence, the new DNA eventually attained the size of that in unirradiated cells. In unirradiated cells, caffeine and theophylline exerted smaller effects, and higher doses (1.5 mM or more) had to be used. At these high doses, DNA synthesis was inhibited and the newly synthesized DNA was made in smaller units than in untreated cells. Both the integrity and the repair of pre-existing DNA were unaffected by caffeine. These results may account for the well-documented sensitization of cells to uv light by caffeine and theophylline, and for the observations that caffeine exerts many of its cytological effects in cultured mammalian cells only if it is present during the DNA synthesis period. (auth)

9713 CALCULATIONS RELATED TO THE APPLICATION OF NEGATIVELY CHARGED PIONS IN RADIOTHERAPY: ABSORBED DOSE, LET SPECTRA, AND CELL SURVIVAL. Armstrong, T. W.; Chandler, K. C. (Oak Ridge National Lab., TN). Radiat. Res.; 58: No. 3, 293-328(Jun 1974).

Calculations using a Monte Carlo radiation transport code and a model for cell inactivation have been carried out to estimate the spatial distributions of the absorbed dose, LET spectra, and the cell survival, RBE, and OER for T-1 human kidney cells produced by a beam of negatively charged pions incident on a slab of tissue. (auth)

9714 RADIATION EFFECTS ON DNA CHAIN GROWTH IN MAMMALIAN CELLS. Watanabe, I. (National Inst. of Radiological Sciences, Chiba, Japan). Radiat. Res.; 58: No. 3, 541-556 (Jun 1974).

The effects of ionizing radiation on DNA replication were investigated autoradiographically at the cellular and subcellular levels in mouse leukemic L5178Y cells. The rate of DNA synthesis at the cellular level was depressed immediately after irradiation and the depression continued for subsequent 2 h. The dose-response curve was biphasic. The D_{37} dose of radiosensitive and radioresistant components was ≤1300 and ≥10,500 rads, respectively. The rate of DNA chain growth as measured by DNA autoradiography was only slightly affected by radiation (D_{37} =

13,000 rads), whereas the initiation of DNA replication seemed to be much more sensitive than the former. Accordingly, it may be reasonable to assume that sensitive and resistant components found at the cellular level are attributed to radiation-induced inhibition of initiation and continuation (chain growth) of DNA replication, respectively. The rate of DNA chain growth after 5-h FUdR treatment (0.02 μM or less) was determined to be 0.54 μm/min in nonirradiated control cells. (auth)

9715 CAUSE OF DEFICIENT DNA SYNTHESIS IN GENERATION 1 OF X-IRRADIATED HeLa CELLS. Hopwood, L. E. (Washington Univ., St. Louis). Radiat. Res.; 58: No. 3, 349-360 (Jun 1974).

The development of the 30 to 40% deficiency in DNA synthesis in HeLa S3 cells in the generation (Generation 1) after the one in which they were irradiated in G1 with 500 rads of 220 kV x rays was examined. Incorporation of thymidine immediately after reversal of FUdR blockade at the beginning of the S phase in Generation 1 and immediately after reversal of puromycin inhibition of protein synthesis in mid-S of Generation 1 appears to be unaffected by radiation. The reduced synthesis is progressively manifested as synthesis proceeds; after reversal of both FUdR and puromycin inhibition, maximum reduction is reached in 10 to 15 min. In independent experiments involving inhibition of protein synthesis in unirradiated cells, this interval is shown to be the average time required for maximum inhibition of DNA synthesis. RNA synthesis in Generation 1 is reduced, but only after S phase has begun. A working model is proposed to account for the deficient synthesis in Generation 1. It is postulated that the DNA strand complementary to the strand with the initial damage is replicated with a lesion opposite that damage, and that replication of this strand in Generation 1 results in deficient synthesis. (auth)

9716 EFFECTS OF SUPEROXIDE RADICALS ON MYOBLAST GROWTH AND DIFFERENTIATION. Michelson, A. M. (Institut de Biologie Physico-Chimique, Paris); Buckingham, M. E. Biochem. Biophys. Res. Commun.; 58: No. 4, 1079-1086(18 Jun 1974).

The effects of superoxide radicals on myoblast growth and differentiation in presence and in absence of carcinogenic hydrocarbons are described. Superoxide dismutase affords strong protection in both cases and also protects the cells against the effects of γ irradiation. (auth)

9717 DIFFERENTIAL CHROMOSOMAL SENSITIVITIES OF ANEUSOMIC CELL CLONES TO UV LIGHT. Kato, H. (National Inst. of Genetics, Mishima, Japan). Exp. Cell Res.; 83: 55-62 (Jan 1974).

Several clonal cell lines trisomic or monosomic for chromosome 10 were isolated from a pseudodiploid Chinese hamster cell line, and their uv-sensitivities, as judged by the production of chromosome aberrations, mitotic delay, and the induction of sister chromatid exchanges, were compared. The frequency of chromosome aberrations was consistently higher in the aneusomic clones than in the parental normal disomic line; monosomic lines exhibited the highest frequency. The elevation in the aberration frequency in the aneusomic clones appeared to be due to the increased production of chromatid deletions. The incidence of chromatid exchanges in these clones was no different from that in the parental line. Following uv irradiation, an elongation of G2 of approx. 2 h was detected in every aneusomic clone, while the parental line showed a mitotic delay of only 0.8 h. Following partial synchronization with 2 mM thymidine and treatment with uv irradiation, sister chromatid exchanges were readily induced in all the clones, the frequency being consistently higher in the parental disomic line than in any aneusomic clones. (auth)

9718 ESTIMATION OF RELATIVE ROLES OF THE NUCLEUS AND OF THE CYTOPLASM IN THE UV-INDUCED INHIBITION OF DIVISION AND KILLING OF THE TISSUE CULTURE CELLS. Sakharov, V. N.; Voronkova, L. N. (Inst. of Chemical Physics, Moscow). Tsitologiya; 16: No. 3, 386-389(Mar 1974). (In Russian).

Whole-cells or only cell nuclei in small colonies of the cultured pig embryo kidney cells were irradiated using an uv-microbeam, the subsequent development of the colonies being studied for several days after irradiation. Experiments show that the inhibition of division and killing of cells is due to a direct uv damage of the nuclei, the cytoplasm playing no important role in this radiation response. The appearance of giant cells along with abnormal mitoses was recorded after uv irradiation. (auth)

9719 REPAIR MECHANISMS IN MAMMALIAN CELLS. Lohman, P. H. M.; Bootsma, D. (TNO, Rijswijk, Netherlands). Mutat. Res.; 23: No. 1, 147-150(Apr 1974).

From International Workshop; Noordwijkerhout, Netherlands (6 May 1973).

Repair mechanisms for DNA in irradiated mammalian cells are discussed under the following headings: evidence for the removal of DNA lesions; evidence for by-passing of DNA lesions; mutations affecting DNA repair in mammalian cells; enzymes involved in DNA repair in mammalian cells; and consequences of repair, misrepair, or defective repair. (ERB)

9720 REPAIR SYNTHESIS AND INDUCTION OF THYMIDINE-RESISTANT VARIANTS IN MOUSE LYMPHOMA CELLS OF DIFFERENT RADIOSENSITIVITY. Fox, M. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Mutat. Res.; 23: No. 1, 129-145(Apr 1974).

An assay system was characterized using excess thymidine (TdR) as a selective agent and the dose-response curve for x-ray induced variants resistant to thymidine was compared with that for x-ray induced variants resistant to 5-iodo-2-deoxyuridine (IUdR) in $P_3$88 lymphoma cells. Dose-response curves showed a linear and a dose squared component in this cell line and were similar in both selective systems. A comparison was made of the dose-response curves for x-ray induced thymidine resistant (TdR^+) variants in four other lymphoma cell lines of differing radiosensitivity. When induced frequencies were compared either at the same dose or at the same survival level the most sensitive line L_{51}78YS was found to be most mutable. Repair replication levels were measured in all cell lines but no correlation between observed levels of repair replication and mutability in the five cell lines was found. The data are discussed in relation to the possible involvement of repair processes in mutation induction by x-rays in mammalian cells. (auth)

9721 REPAIR OF X-RAY DAMAGE IN AGING WI-38 CELLS. Clarkson, J. M.; Painter, R. B. (Univ. of California, San Francisco). Mutat. Res.; 23: No. 1, 107-112(Apr 1974).

Rate of strand rejoining and the ability to perform repair replication were determined in young and old x-irradiated WI-38 cells. No differences in either process were apparent and we conclude that reduced efficiency in one or both of them is not responsible for in vitro aging of human cells. (auth)

9722 CHANGE IN THE POLARIZATION FLUORESCENCE OF CELLS UNDERGOING DAMAGE. Zotikov, A. A.; Shiffers, L. A. (Inst. of Molecular Biology, Moscow). Izv. Akad. Nauk SSSR, Ser. Biol.; 5: 744-747(1973). (In Russian)

The change of the polarization degree of uv fluorescence of normal and damaged cells of Tetrahymena pyriformis was investigated. It was shown that the polarization degree of fluorescence of cells under the influence of the elevated temperature and 8M urea on the proteins in cells is diminshed. The polarization of fluorescence of cells has been investigated also in visible range of the spectra. The change of polarization degree of fluorescence of irradiated cells seems mainly due to the change of the conformation of the nucleic acids in cells. (ERB)

Radiation Effects on Microorganisms

Refer also to abstracts 9697, 9698, 9703, 9734, 9763, 9766, 9781, 12112, 12133, 12134, and 12136.

9723 (COO-1156-66) CHRONIC GAMMA RADIATION STRESS ON SOIL MICROORGANISMS OF A GRASSLAND. Sparrow, S. Jr. (Colorado State Univ., Fort Collins (USA)). May 1973. 115p. Dep. NTIS $8.75.

Thesis.

A study was made of chronic gamma radiation stress on microbial and chemical characteristics of soil in a short-grass ecosystem in northeastern Colorado. Over a 3-year period, the grassland was constantly irradiated from an 8750 Ci ^{137}Co γ source. Soil samples were collected during the summer and fall of 1972 from areas where plants were killed (plant-lethal zone) and from those where plants were little affected or unaffected by the radiation. Numbers of total aerobic bacteria, actinomycetes, and fungi in the soil samples were estimated by the plate count method; algal abundance and numbers of nitrifying bacteria were determined using the most-probable-number technique. Carbon dioxide evolution rates under field conditions were measured by trapping CO_2 in NaOH, which was then titrated with acid. Also, as a rapid and sensitive test for measuring carbon turnover rate, a mixture of labeled plant material was added to the soil and the evolved CO_2 analyzed for radioactivity. On most sampling dates total numbers of aerobic bacteria were not appreciably changed across the radiation gradient; actinomycete and fungal numbers were depressed near the source. Regression analysis indicated that fungi were more susceptible to radiation damage than the other groups of microorganisms. Total soil organic matter levels in the soil remained nearly constant across the radiation gradient, indicating that relatively little decomposition took place in the plant-lethal zone. However, some decomposition was apparently occurring in this zone since appreciable quantities of CO_2 were evolved from soil near the source. (auth)

9724 (COO-2362-1) BASIC ASPECTS OF RADIATION ACTION ON MICROORGANISMS. Progress Report, May 31, 1973–January 1, 1974. Pollard, E. C. (Pennsylvania State Univ., University Park (USA). Dept. of Biophysics). Feb 1974. Contract AT(11-1)-2362. 7p. Dep. NTIS $4.00.

Progress is reported on studies of molecular reactions involved in the induction of bacteriophage of Escherichia coli following exposure to ionizing radiation. The role of DNA synthesis is discussed briefly. A list is included of publications that report results of the studies in detail. (CH)

9725 (COO-2403-6) EARLY STEPS IN PROTEIN SYNTHESIS AND THEIR REGULATION: A BACKGROUND STUDY RELATED TO THE BIOLOGICAL EFFECTS OF RADIATION. Progress Report, July 1, 1973–June 30, 1974. Zamecnik, P. C. (Massachusetts General Hospital, Boston (USA). John Collins Warren Labs.). 1974. Contract AT(11-1)-2403. 34p. Dep. NTIS $4.75.

9726 (IAEA-R-570-F) MECHANISM OF RADIATION AND HEAT RESISTANCE OF CLOSTRIDIUM BOTULINUM. Part of a Coordinated Programme of Research in Microbiological Aspects of Food Irradiation. Final Report, 1 November 1967–30 November 1971. Grecz, N. (International Atomic Energy Agency, Vienna (Austria)). 1972. vp. INIS.

Bacterial spores are usually resistant to ionizing radiation treatment. Large radiation doses are needed to rid food products of these spores. Studies to investigate the combined effect of radiation plus heat on bacterial spores in aqueous systems were undertaken. Spores of Bacillus cereus and Bacillus stearothermophilus were converted to both heat sensitive and heat resistant state. Irradiation of the different spores was done at a dose of 0.45 Mrad at an irradiation temperature of –15 to 120°C. Radiation survival of the spores was determined by microscopic and plate counts. Involvement of radicals in the radiation response of spores was investigated by suspending the different spore forms in ethanol and sodium nitrate. It was demonstrated that radiation action on spores of B cereus and B stearothermophilus was small. The major lethal effect on these spores was due to heat. Radical scavengers, 2 M ethanol and 1 M sodium nitrate, were found to increase the lethal contribution of radiation. Moreover, scavenger studies suggested that these radicals had a lethal action on spores when temperatures during irradiation were above 50°C. (INIS)

9727 (IAEA-R-810-F) CATALYTIC INFLUENCE OF GAMMA RAYS (Co-60) ON THE PIGMENT DEGRADATION REACTIONS IN SEA PRODUCTS (CRUSTACEA AND FISH). Final Report, 1 November 1969–31 October 1972. Maes, E.; Tobback, P.; Snauwaert, F. (International Atomic Energy Agency, Vienna (Austria)). Sep 1972. vp. INIS.

Gamma radiation has been shown to be a potential preservation process for various species of crustacea including shrimps. Results obtained from irradiation studies on the brown shrimp (Crangon vulgaris Fabr.) indicated the feasibility of applying the process for the extension of the market life of the product. However, some color changes were reported in the processed seafood. Elucidation of the influence of gamma rays on the carotenoids of the brown shrimp merits special studies. Carotenoids present in boiled and unboiled unpeeled brown shrimp were extracted using various extraction procedures. Quantitative determinations of the isolated carotenoids were done spectrophotometrically, while their separation from the crude extracts was chromatographically made. The effect of gamma radiation on the stability of the carotenoids in the shrimp was also studied. Moreover, studies on the influence of the radiation process on the stability of commercially available crystalline beta-carotene dissolved in various solvents were undertaken. Purification and identification of pigments of the boiled brown shrimp revealed the presence of at least seven carotenoids. Among these were beta-carotene, astaxanthin, and the mono- and di-ester of astaxanthin. Carotenoids of the shrimp were found to be remarkably stable upon irradiation. Irradiation of the pure crystalline beta-carotene in different solvents resulted in cis-trans-isomerism, shortening of the conjugated system, and formation of α-isomers. (INIS)

9728 (ORO-4024-4(App. 1)) EFFECT OF RADIATION-SENSITIVE MUTATIONS AND RADIATION ON RECOMBINATION IN PARTIALLY DIPLOID DERIVATIVES OF ESCHERICHIA COLI. Progress Report. Knudson, A. G. Jr. (Texas Univ., Houston (USA). Graduate School of Biomedical Sciences). May 1974. Contract AT(40-1)-4024. 16p. Dep. NTIS $4.00.

Progress is reported in studies on the effects of radiation on gene recombination in chromosomes of Escherichia coli. Data are included on the repair system responsible for the removal of uv-induced thymine dimers in E. coli and the relationship of thymine dimers to gene conversion processes. A list is included of published papers that report the results of studies completed. (CH)

9729 ISOLATION AND CHARACTERISATION OF A MUTANT OF SALMONELLA TYPHIMURIUM DEFECTIVE IN MUTATION FREQUENCY DECLINE. Williams, P. H.; Clarke, C. H. (Univ. of East Anglia, Norwich, Eng.). Mutat. Res.; 22: No. 3, 243-253 (Mar 1974).

A mutant of Salmonella typhimurium strain $trpC_3$ has been isolated which is defective in mutation frequency decline (MFD) for uv-induced suppressor revertants to tryptophan independence. Several characteristics of this mutant, PW_4, suggest that it is altered in the timing or rate of the general excision repair mechanism. Survival is greater in strain PW_4 when the first post-irradiation cell division is delayed by the inhibition of immediate protein synthesis. Similarly, stationary phase cells, which show an extended lag after irradiation, are more uv-resistant than lag-phase cells, which recover more rapidly. These data are consistent with the hypothesis that, in contrast with the parent strain $trpC_3$, the time available in the mutant strain for the action of excision repair is critical in the determination of survival after uv treatment. Cotransductional analysis of the mutant locus indicates close linkage to metE, a region in which excision repair genes have been located. (auth)

9730 MUTATION FREQUENCY DECLINE FOLLOWING CHEMICAL MUTAGENESIS OF SALMONELLA TYPHIMURIUM. Williams, P. H.; Clarke, C. H. (Univ. of East Anglia, Norwich, Eng.). Mutat. Res.; 22: No. 3, 255-264(Mar 1974).

The occurrence is reported of a mutation frequency decline process (MFD) following treatment of Salmonella typhimurium strain $trpC_3$ with two chemical mutagens which give rise predominantly to suppressor revertants. With the carcinogen 4-nitroquinoline-N-oxide (4NQO) the results are analogous to those obtained for uv-mutagenesis. In the case of methoxyamine, the process is due to specific excision of premutational lesions, since lethality is low and lethal lesions are non-excisable. Mutants are described that cannot perform MFD of lesions induced by one or both of the chemical mutagens, indicating that the loss of revertants is in each case due to a bacterial repair system rather than to spontaneous degradation of the induced lesion. These mutants, however, were isolated because of an altered response to uv mutagenesis, viz., their ability to express uv-induced mutants in the absence of amino acids to stimulate active post-irradiation protein synthesis. In all other respects tested, their response to uv is identical with that of the parent strain. The hypothesis is discussed that the total absence of uv-induced revertants of the strain S. typhimurium $trpC_3$ when active protein synthesis is inhibited is due to two processes, first, rapid MFD due to the specific excision of pyrimidine dimers (the predominant uv-lesion) and secondly, the slow excision of other premutational damage which may be other photoproducts or secondary distortions caused by close juxtaposition of several pyrimidine dimers. (auth)

9731 GAMMA RADIOINDUCED ACIDITY IN CORN STARCH. Athanassiadis, H.; Berger, G. (CEN de Cadarache, Saint-Paul-les-Durance, France). Staerke; 25: No. 11, 362-367(Nov 1973). (In French).

Amounts of radioinduced acids and esters in corn starch were measured in terms of different conditions of irradiation (dose, dose rate, temperature, atmosphere) and of starch characteristics (% water, impurities, kind of glucosidic linkage) and results were compared to those given by heat sterilization. Subsequent development of acidity has been checked during the storage at ambient temperature. (auth)

9732 EFFECT OF CHLORAMPHENICOL AND TETRACYCLINE ON THE PROTEIN SYNTHESIS OF CERTAIN MUTANTS OF E. COLI IRRADIATED WITH UV RAYS. Marinova, Z. I.; Petrova, S. N.; Daneva, M. A.; Todorov, S. L. (Inst. of Radiology and Radiation Hygiene, Sofia). Compt. Rend. Acad. Bulg. Sci.; 27: No. 2, 255-258(1974).

In order to explain certain aspects of the combined effect of the radiation and some antibiotics on vitally indispensable processes such as the synthesis of nucleic acids and protein, it is convenient to use a non-dividing cell culture. The degree to which protein synthesis is inhibited by chloramphenicol and tetracycline in non-dividing cells of E. coli and mutants of E. coli irradiated with a constant and impairing dose, compared with that of non-irradiated cells, was studied. The experiments with the initial strains show a distinct difference in the effects of the two antibiotics on irradiated and non-irradiated bacteria. Following irradiation the protein synthesis is affected to a lesser extent, and it is even stimulated at a concentration of the antibiotics of 0,1 γ/ml. Such an effect is not to be established for the two radiosensitive mutants. In them the effect of the antibiotics used is demonstrated either by one and the same degree

of inhibition of the protein synthesis for irradiated and non-irradiated bacteria (E. coli hcr$^-$) or by a higher degree of inhibition of the irradiated bacteria (E. coli 2480 and E. coli hcr$^-$ and E. coli 2480). The opinion has been expressed that better conditions for repairing are created upon a temporary inhibition of the protein synthesis in the cell. That is why in the strains with adequate repairing system the intensification of the protein synthesis upon the administration of tetracycline and chloramphenicol could be the result of a fuller restoration of the DNA. (ERB)

9733 MICROBIOLOGICAL AND TECHNOLOGICAL EFFECTS OF GAMMA IRRADIATION ON RIPE SAN MARZANO TOMATOES STORED IN DIFFERENT CONDITIONS. Inghilesi, E.; Magaudda, G. (CNEN, Casaccia, Italy). Lebensm.-Wiss. Technol.; 3: No. 2, 91-94(1973). (In Italian).

9734 IDENTIFICATION OF IRRADIATED FOODSTUFFS. Critical Remarks on an International Colloquium. Diehl, J. F. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). KFK Nachr.; 5: No. 4, 34-35(1973). (In German).

From symposium on the identification of irradiated foods; Karlsruhe, Ger. (24 Oct 1973).

Chemical and biological methods for the identification of irradiated foodstuffs are briefly reviewed, together with possible improvements of these methods. The research work that has to be done to meet the stringent requirements of the legal provisions for comparing the wholesomeness of irradiated food with that of chemically treated foodstuffs is discussed. (GE)

9735 THERMAL ENHANCEMENT OF ULTRAVIOLET MUTABILITY IN A tif-1 uvrA DERIVATIVE OF ESCHERICHIA COLI B/r: EVIDENCE THAT ULTRAVIOLET MUTAGENESIS DEPENDS UPON AN INDUCIBLE FUNCTION. Witkin, E. M. (Douglass Coll., New Brunswick, NJ). Proc. Nat. Acad. Sci. U. S. A.; 71: No. 5, 1930-1934(May 1974).

Inhibition of DNA replication in E. coli results in coordinate expression of a cluster of diverse functions, including prophage induction and filamentous growth, many of which are thermally inducible, without inhibition of DNA synthesis, in strains carrying a mutation in the "tif" locus. It has been proposed that one of the inducible functions in this cluster is responsible for the ultraviolet mutability of E. coli. As a test of this hypothesis, the effect of postirradiation temperature elevation on ultraviolet mutability was compared in strains differing by a tif mutation. In a tif$^+$ strain, raising the temperature to 42° after irradiation did not change the frequency of induced mutations to tryptophan-independence. Similar treatment of a tif-1 strain resulted in as much as a 10-fold increase in the induced mutation yield. Thermal enhancement of ultraviolet mutability in the tif-1 strain was prevented or promoted by agents known to exert parallel effects on thermal induction of lambda prophage in tif lysogens. The results support the hypothesis that ultraviolet mutability in E. coli depends upon an inducible function that is normally expressed only when DNA replication is inhibited. (auth)

9736 CONDITIONAL LETHAL MUTANT OF ESCHERICHIA COLI K12 DEFECTIVE IN THE 5′ → 3′ EXONUCLEASE ASSOCIATED WITH DNA POLYMERASE I. Konrad, E. B.; Lehman, I. R. (Stanford Univ., CA). Proc. Nat. Acad. Sci. U. S. A.; 71: No. 5, 2048-2051(May 1974).

A mutant strain of E. coli, initially identified by an abnormally high frequency of recombination, has been found to be defective in the 5′ → 3′ exonuclease associated with DNA polymerase I, but not in the polymerase activity. This defect is tolerated at 30°C, but is lethal at 43°. Like other polymerase I mutants, the strain is unusually sensitive to methyl methanesulfonate and to ultraviolet irradiation; it is also unable to support the growth of phage λ defective in general recombination, and shows a reduced rate of joining of 10S "Okazaki fragments." These results demonstrate that a functional DNA polymerase I is essential for normal growth and viability in E. coli K12. (auth)

9737 MODIFICATION OF RADIATION SENSITIVITY OF BACTERIAL SPORES BY SILVER SALTS. Richmond, R. C.; Powers, E. L. (Univ. of Texas, Austin). Radiat. Res.; 58: No. 3, 470-480(Jun 1974).

In the absence of O_2 Ag^+ sensitizes spores of Bacillus megaterium in aqueous suspension to 50 kVp x rays in a concentration-dependent fashion. The sensitization maximum, equal to the full O_2 effect, is reached at about 2×10^{-3} M Ag^+ as Ag_2SO_4. At higher concentrations biphasic survival curves are produced indicating greater radiation resistance in the higher dose range. Tertiary butanol can almost completely reverse the sensitization determined by Ag^+. These results are consistent with the ·OH radical theory of sensitization previously offered from this laboratory. In O_2-saturated suspensions, Ag_2SO_4 produces an "over O_2" effect that is dependent on concentration of O_2, with higher concentrations of O_2 determining a smaller degree of sensitivity. This effect may involve competition between O_2 and Ag^+ for e^-_{aq}, with $Ag^+ + e^-_{aq}$ being required. $AgNO_3$ is of interest because of the separate sensitizing action of NO_3^-. In N_2, $AgNO_3$ also sensitizes to the O_2 level, an effect greater than NO_3^- alone. In O_2, a small "over O_2" effect is produced, but one much smaller than NO_3^- as $NaNO_3$. The ·OH radical involvement in sensitization is supported, but full explanations must await additional radiation chemistry of these systems. (auth)

9738 MODIFICATION OF RADIATION SENSITIVITY OF BACILLUS MEGATERIUM SPORES BY N_2O AND p-NITROACETOPHENONE. Ewing, D.; Fielden, E. M.; Roberts, P. B. (Inst. of Cancer Research, Sutton, Eng.). Radiat. Res.; 58: No. 3, 481-488 (Jun 1974).

The basic anoxic radiosensitivity of B. megaterium spores irradiated in buffered aqueous suspension can be increased by up to 40% by the addition of PNAP to the suspension. At the highest concentrations, above 6×10^{-4} M PNAP, this increased sensitivity is constant and cannot be reduced by the addition of t-butanol as an OH scavenger. This does not hold, however, at lower concentrations at which PNAP exerts a submaximal sensitizing action since in this range t-butanol can eliminate the effect of PNAP. Nitrous oxide produces radiosensitization in the spore system that can be completely reversed by the presence of t-butanol. PNAP, however, can apparently only partially remove the sensitization produced by nitrous oxide. These results are explained in terms of indirect, or water radical-mediated, sensitization by nitrous oxide or low concentrations of PNAP. High concentrations of PNAP, however, are believed to enhance the lethality of the direct effects of radiation on the cellular target and this effect is independent of the presence of nitrous oxide. (auth)

9739 ADDITIVE EFFECTS IN THE RADIOSENSITIZATION OF B. MEGATERIUM SPORES BY p-NITROACETOPHENONE AND NORPSEUDOPELLETIERINE-N-OXYL. Fielden, E. M.; Ewing, D.; Roberts, P. B. (Inst. of Cancer Research, Sutton, Eng.). Radiat. Res.; 58: No. 3, 489-497(Jun 1974).

Norpseudopelletierine-N-oxyl (NPPN) has been shown to increase the sensitivity of B. megaterium spores when irradiated in anoxic buffered suspensions. The maximum sensitization achieved by NPPN alone corresponded to a 58% increase over the simple anoxic response. This compares with a 40% increase produced by paranitroacetophenone (PNAP) and 115% increase shown by oxygen. Like PNAP, NPPN is capable of producing a small measure of sensitization by interfering with water radiolysis intermediates (indirect affects) when used at low concentrations. At high concentrations, at which NPPN exerts its maximum degree of sensitization, it is concluded that the compound operates by increasing the lethality of the direct effects of radiation on the cellular target. The use of mixtures of NPPN and PNAP produces a greater degree of sensitization than can be achieved by either alone, at least a 91% increase over the anoxic sensitivity being observed. It is concluded that these two sensitizers, chosen as representatives of the electron-affinic class (PNAP) and of the free radical nitroxyl class (NPPN) of sensitizers do act through different mechanisms. (auth)

9740 FINE STRUCTURE MAPPING IN YEAST WITH SUNLAMP RADIATION. Lawrence, C. W.; Christensen, R. (Univ. of Rochester, NY). Genetics; 76: No. 4, 723-733(Apr 1974).

The x-ray mapping procedure of Manney and Mortimer (1964) is the most widely applicable and convenient method for fine structure analysis in yeast, but suffers the disadvantage that suitable x-ray machines or gamma ray sources are very expensive. Although many other recombinogens are known, none gives a linear dose-response like x-rays and few are convenient or give as reproducible results. Experiments with Saccharomyces cerevisiae reported in this paper show, however, that the near-ultraviolet radiation emitted by fluorescent sunlamps gives linear dose-response relations, as reproducible results as ionizing radiations, and map distances which correlate highly with those obtained by using ^{60}Co gamma rays. It is suggested that this convenient recombinogen may be a suitable low-cost substitute for ionizing radiations in fine structure mapping. (auth)

9741 EFFECT OF ULTRAVIOLET LIGHT ON THE SYMBIOTIC EFFECTIVENESS AND SOME PHYSIOLOGICAL CHARACTERISTICS OF FOUR STRAINS OF RHIZOBIUM TRIFOLII. Russell, P. E.; Jones, D. G. (University Coll. of Wales, Aberystwyth, Eng.). J. Appl. Bacteriol.; 36: No. 4, 567-573(Dec 1973).

Ultraviolet light was used to induce mutations in 4 strains of Rhizobium trifolii. Mutations were found with modified acid production, generation time, polysaccharide production, and symbiotic effectiveness on S184 white clover. Of 72 mutants examined, one was more effective than the parent, 9 had either similar or reduced effectiveness compared with their parental strains, and the remainder were non-infective. A significant

correlation ($P \leq 0.05$) was found between the effectiveness of the strains and their acid production on an agar medium but no such relationship was found in liquid medium. No other relationships were found between any of the physiological or symbiotic characteristics examined. (auth)

9742 EFFECT OF PHYSICO-CHEMICAL FACTORS ON INFLUENZA VIRUS NEURAMINIDASE. Neklyudov, L. I.; Orlova, N. G.; Makarova, G. I. (Central Inst. of Medical Research, Moscow). Vop. Virusol.; 18: 338-341(1973). (In Russian).

The effect of temperature, formalin, and ultraviolet rays on the hemagglutinating and neuraminidase activity of influenza A2/Hong Kong virus was studied. A considerable change of the antigenic specific neuraminidase under the effect of formalin and ultraviolet rays was found, the specificity of hemagglutinin remaining unchanged under similar conditions. Thermolability of the enzyme of the strain under study was established. (auth)

9743 ULTRAVIOLET-INDUCED MUTAGENESIS IN THE WP_2 STRAIN OF ESCHERICHIA COLI ON FRACTIONATED AND CONTINUOUS IRRADIATION. Likhoded, L. Ya.; Skavronskaya, A. G. (Inst. of Epidemiology and Microbiology, Moscow). Sov. Genet. (Engl. Transl.); 7: No. 5, 661-663(May 1971).

Translated from Genetica; 7: No. 5, 138-141(May 1971).

The mutagenic effect in E. coli WP_2 cells subjected to fractionated uv irradiation is smaller than that in cells subjected to continuous irradiation in the same doses. With equal mortality rates, continuously and fractionally irradiated bacteria exhibit no substantial differences in the frequency of uv-induced mutations. Under conditions that prevent DNA synthesis, excisional repair is apparently accompanied by few or no errors leading to formation of uv-induced prototrophic revertants. (auth)

9744 INFLUENCE OF OXYGEN ON THE RADIATION DAMAGE OF HIGH-ENERGY BREMSSTRAHLUNG. Zywietz, F.; Brueckner, V.; Baisch, H. (Hamburg Univ.). pp 287-291 of Radiation Biophysics, Free Radicals. Vol. II. Broda, E. (ed.). Vienna; Wiener Medizinische Akademie (1971).

From first European biophysics congress; Baden, Austria (14 Sep 1971).

Continuing former investigations on the radiation damage of GeV-bremsstrahlung on E. coli bacteria, the influence of oxygen on the radiosensitivity of bacteria at different depths in a water phantom was studied. Irradiation techniques and cell preparation are described. Irradiation of cells at depths of 0.5, 15, 70, 110, and 150 cm of water leads to exponential dose-response curves, from which the radiosensitivity L/D_{37} can be calculated. A decrease in radiosensitivity of 40% was obtained after 20 cm of water, then the value remains constant over four radiation lengths. The production of neutrons and nuclear fragments and their influence on RBE and radiosensitivity with depth is discussed. (auth)

9745 ISOLATION AND PROPERTIES OF RECOMBINATION-DEFICIENT MUTANTS OF PSEUDOMONAS AERUGINOSA. Chandler, P. M.; Krishnapillai, V. (Monash Univ., Clayton, Australia). Mutat. Res.; 23: No. 1, 15-23(Apr 1974).

Two recombination-deficient (rec) mutants of Pseudomonas aeruginosa strain PAO were isolated following nitrosoguanidine mutagenesis. Recombinant yields in these mutants were reduced by a factor of approx. 10^4 in conjugation, and 10^3 in transduction relative to the rec^+ parent. Associated with their severe recombination deficiency was an increased sensitivity to radiomimetic chemicals and hypersensitivity to uv-irradiation. The capacity of the mutants to reactivate uv-irradiated phages was, however, normal. The inducible phages F116L and D_3 could not be induced in a rec host, and neither could the synthesis of two different inducible aeruginocins of strain PAO, one of which structurally resembles phage tails and whose genetic determinant maps with a chromosomal location. Reversion studies indicated that the pleiotropic properties of at least one of the rec mutants were probably due to a single mutation. The phenotypic characteristics of these mutants suggested that they were analogous to the rec A mutants of E. coli K-12. The absence of a functional recombination system in the mutants did not affect their ability to transfer the sex factor FP2, but markedly reduced the extent of chromosome transfer mediated by this plasmid. (auth)

9746 OCCURRENCE AND PROPERTIES OF TEMPERATE PHAGES OF PSEUDOMONAS MORSPRUNORUM. III. Transduction of the Streptomycin-Resistance. Luedcke, E. C. (Technische Univ., Hanover). Zentralbl. Bakteriol. Parasitenk., Abt. II; 127: 564-572(1972). (In German).

Tests to prove transduction were carried out with lysogenic, uv-mutated bacteria. The maximum mutation-rate was obtained at 30 sec uv irradiation. Selection of mutants for resistance to antibiotics proved to be best. Twenty Sr-mutants of the lysogenic bacterial strain and 5 Sr-mutants of the homologous detector strain were isolated. A transduction of the streptomycin-resistance to the sensitive detector-strain was possible with the aid of temperature bacteriophages. The frequency of transduction was 1.3×10^{-7}. Tests to transform the streptomycin-resistance were not successful. A superinfection of the transductants with the homologous phage was not possible because of the immunity barrier. Reactivation of the phages in the recombinants was successful by using uv irradiation. (auth)

9747 INFLUENCE OF SOME RADIOSENSITIZERS ON GAMMA-RAY-INDUCED DEGRADATION OF DNA IN THE BLUE-GREEN ALGA, ANACYSTIS NIDULANS. Dmitriev, A. P.; Grodzinskii, D. M. (Inst. of Physics of Plants, Kiev). Radiat. Bot.; 14: No. 1, 11-15(Apr 1974).

The blue-green algae appear to have maintained efficient repair systems. They were sensitized to gamma irradiation by chemical sensitizers. Evidence is presented for the influence of sensitizers on post-irradiation DNA degradation. Uracil-^{14}C labelled Anacystis nidulans were irradiated in the presence of solutions of various radiosensitizers. Loss of radioactivity from the acid-precipitable DNA was used as a measure of DNA breakdown. Iodoacetic acid, p-chloromercuribenzoate, indanetrione, methylhydrazine, and iodobenzoic acid were used at optimum concentrations for sensitization (cell survival). Four sensitizers, iodoacetic acid (3×10^{-4}M), indanetrione (10^{-4}M), methylhydrazine (10^{-4}M) and iodobenzoic acid (2×10^{-4}M), almost completely inhibited post-irradiation breakdown, but p-chloromercuribenzoate (10^{-5}M) had only a slight inhibitory effect. It was concluded that for this alga, DNA degradation could be affected by various sensitizers. (auth)

9748 MODIFICATION OF THE RADIATION RESISTANCE OF ASPERGILLUS FLAVUS CONIDIA BY SOME CHEMICALS. Mohyuddin, M.; Osman, N. (Nuclear Inst. for Agriculture and Biology, Lyallpur, Pakistan). Radiat. Bot.; 14: No. 1, 23-27 (Apr 1974).

Survival curves for conidia of Aspergillus flavus Link var. columnaris Raper and Fennell were obtained after irradiation with gamma rays in the presence of NaCl, iodized salt, KNO_2, $NaNO_3$, $NaNO_2$, iodoacetamide and iodoacetic acid. Presence of NaCl at the time of irradiation sensitized the conidia, while conidia harvested from a medium containing NaCl and irradiated in distilled water, exhibited higher radiation resistance. Iodized salt had a greater sensitizing capacity than ordinary salt. Potassium nitrite did not behave synergistically, while $NaNO_2$ and $NaNO_3$ both enhanced the lethal effects of radiation. Iodoacetamide, iodoacetic acid and vitamin K_3 possessed very strong radiosensitizing capacities. (auth)

9749 ULTRAVIOLET LIGHT SENSITIVE MUTANTS OF COPRINUS LAGOPUS. I. Isolation and Characterization. Rahman, M. A.; Cowan, J. W. (King's Coll., London). Mutat. Res.; 23: No. 1, 29-40(Apr 1974).

Four uv-sensitive mutants were isolated from the wild type strain $BC_3/66$ of Coprinus lagopus by following a new replica plating technique. Complementation and recombination studies between these mutants suggest 3 gene loci uvs1, uvs2, and uvs3, two of the mutants being allelic (uv3-1 and uvs3-2). The mutants uvs2, uvs3-1, and uvs3-2 show photoreactivation whereas the mutant uvs1 appears to be deficient in this respect. None of the mutants or the wild type showed significant recovery after dark holding. (auth)

9750 RELATIONSHIP BETWEEN PEEL DAMAGE AND THE ACCUMULATION OF TERPENE COMPOUNDS IN IRRADIATED ORANGES. Belli-Donini, M. L.; Baraldi, D.; Taggi, R. (CNEN, Casaccia, Italy). Radiat. Bot.; 14: No. 1, 1-9(Apr 1974).

A study was made of the effects of γ radiation on the accumulation of various terpene compounds that are the main components of the oil glands in citrus fruits. Control samples of three orange varieties did not show any exocarp browning during storage, whereas the irradiated samples of the Tarocco and Valencia late varieties, when exposed to dosages higher than 100 krad, showed definite browning after 3 weeks. The Ovale oranges, even after exposure to 200 krad did not show any exocarp damage at the end of a 2 month storage. Quantitative differences, especially for limonene, were found between the terpene compounds in the control samples. In the irradiated samples, the terpene components consistently increased with time and irradiation exposures. The magnitude of this increase depends upon the variety. Since there is no exocarp browning in Ovale, it might be argued that the manifestation of the exocarp browning phenomenon is related to its low limonene content. It is hypothesized that irradiation induces damage to the skin tissue of oranges by facilitating the diffusion of terpene compounds in exocarp cells. (auth)

9751 EFFECT OF DIFFERENT RADIATION DOSES ON THE TOTAL FAT CONTENT OF CORN. Dorantes, R. V. Queretaro,

Mexico; Universidad Autonoma de Queretarc (1974). 85p. (In Spanish).

Thesis.

The present status of the disinfestation of corn by irradiation is summarized. The characteristics of radiation sources and irradiation facilities are briefly reported. The chemical effects of radiation, specifically the radiolysis of water and the modification of organic compounds, are considered. The lipids present in corn are classified and their importance is discussed. The results obtained in previous studies on the effects of radiation on lipids are summarized. The experimental installation used in the present study on corn is described. The corn was irradiated with γ rays at doses from 10 to 10,000 krad. The results showed that the original total fat content of the corn is not affected at doses up to 10 Mrad. The irradiation causes a slight increase in the molecular weight of the oils. The concentration of double bonds can be increased or decreased with the irradiation dose depending on the type of oil. The irradiation decomposes the lipids into acids with a shorter chain and methyl and ethyl esters soluble in ether. (JSR)

9752 RELATION BETWEEN CONTENTS IN CALCIUM IONS AND SOLUBILITY OF PECTIC SUBSTANCES IN IRRADIATED AND STORED STRAWBERRIES. Belli-Donini, M. L. (CNEN, Rome). Agrochimica; 17: No. 3-4, 370-376(1973). (In Italian). (RT/BIO-(73)27).

Red Gauntlet strawberries were picked at preclimacteric stage and irradiated at 200 krads by means of a ^{60}Co source. After irradiation the strawberries were kept at a temperature of 3°C ± 1 and a relative humidity of 90 to 95%. The following analyses were carried out on the samples collected at regular intervals during the storage period: total amount and soluble fraction of calcium, content of pectic substances, and pectinmethylesterase (PE) activity. The estimation of the results obtained shows no irradiation effect in the soluble calcium (the amount of which is not changed), while both the amount of calcium pectates and the PE activity are reduced at the exposure applied. It may be concluded that in strawberries the solubility of the pectic substances is mainly an enzymatic process. (auth)

9753 EFFECT OF IONIZING RADIATION ON DRUGS. Riabykh, L. D.; Chakchir, B. A.; Grachev, S. A. Voenno-Med. Zh.; 84-86(Nov 1973). (In Russian).

Radiation sensitivity of various groups of medical preparations and drugs is discussed by reviewing the available literature on the subject. Hormones, alkaloids, antibiotics, and anesthetics are covered in solid form, in solutions, and sealed vials. Radiation damage thresholds are indicated for some groups of medicines. (IAA)

9754 ANTIMICROBIAL TREATMENT OF DOSAGE FORMS BY GAMMA-RADIATION. Affolter, H.; Speiser, P. (Eidgenoessische Hochschule, Zurich). Pharm. Acta Helv.; 48: No. 10, 525-540(Oct 1973). (In German).

A review is given including the treatment with γ radiation as an antimicrobial proceeding and the chemical and biological effects of this radiation. Some of the theory of radiation effects are referred to in order to outline the practical possibility of that theory for the disinfection of the packed dosage forms. (auth)

9755 ANTIMICROBIAL TREATMENT OF OINTMENTS AND OINTMENT BASES WITH GAMMA-RADIATION. Affolter, H.; Speiser, P. (Eidgenoessische Technische Hochschule, Zurich). Pharm. Acta Helv.; 48: 570-587(Oct 1973). (In German).

The inactivation of microorganisms in ointments and its components treated with γ radiation was investigated. Two ointment bases are contaminated with two test spores and exposed to radiation. Further it could be proved statistically, that the logarithm of the surviving fraction is equal to the multiple of radiation dose and negative radiosensitivity of the germs. The comparison of these survival curves shows a significant difference not only between the germs but even more between the mediums. Conditions and general directions concerning the antimicrobial treatment with radiation are discussed. (auth)

9756 ULTRAVIOLET- AND GAMMA-INACTIVATION OF CONIDIA FROM HETEROKARYONS OF NEUROSPORA CRASSA CONTAINING UV-SENSITIVE MUTATIONS. Shelby, M. D. Knoxville, TN; Univ. of Tennessee (1973). 106p. University Microfilms Order No. 74-3867.

Thesis (Ph. D.).

The effect of three uv-sensitive mutations of Neurospora crassa, upr-1, uvs-4, and uvs-6, on the ultraviolet and gamma ray-inactivation of conidia from two-component heterokaryons was investigated. In two-component heterokaryons with wild-type sensitivity to radiation inactivation, all three conidial fractions exhibited the same broad shouldered ultraviolet-inactivation curve. In contrast, gamma rays inactivated heterokaryotic conidia exponentially while homokaryotic conidia were more resistant and exhibited a shouldered inactivation curve. Each uv-sensitive mutation studied uniquely modified the ultraviolet and gamma ray-inactivation curves of conidia from two-component heterokaryons. In heterokaryons heterokaryotic for upr-1, the mutation was recessive and the repair function determined by the wild-type allele was functional to some degree in homokaryotic upr-1 conidia. Ultraviolet-sensitivity was greatly increased in all three conidial fractions when heterokaryons contained upr-1 in both components. Ultraviolet-inactivation curves resembled those obtained with gamma rays in wild-type heterokaryons. The effects of upr-1 on gamma ray survival curves were small resulting in less than a ten-fold increase in sensitivity when upr-1 was included in both components. The uvs-4 mutation was recessive and resulted in conidia with increased uv-sensitivity only when included in both components of a heterokaryon. Homokaryotic uvs-4 conidia, which arose from heterokaryons containing both uvs-4 and wild-type components, exhibited wild-type survival. Therefore, as with upr-1, there was a carryover of the repair capability to conidia which were genetically uv-sensitive. Sensitivity to gamma-irradiation of conidia from uvs-4-containing heterokaryons was the same as wild-type or slightly decreased. The uvs-6 mutation, when included in one component of a heterokaryon, resulted in increased uv-sensitivity of both heterokaryotic and homokaryotic uvs-6 conidia. When both components contained uvs-6, the uv-sensitivity of all three conidial fractions was increased and all showed similar inactivation curves. Only the homokaryotic uvs-6 conidia exhibited increased sensitivity to gamma rays when the heterokaryon was heterokaryotic for uvs-6. Heterokaryons homokaryotic for uvs-6 produced three gamma ray-sensitive conidial fractions all of which exhibited exponential inactivation. This was the most gamma ray-sensitive of the three mutations studied. A cytoplasmic carryover of the function determined by the wild-type allele was seen as in the cases of upr-1 and uvs-4. Heterokaryon tests for complementation between two non-allelic uv-sensitive mutations (upr-1, uvs-4) showed that complete complementation occurred in heterokaryotic conidia. (Diss. Abstr. Int., B)

9757 BACTERIOPHAGE T4 GENE EXPRESSION. O'Farrell, P. Z.; Gold, L. M. (Univ. of Colorado, Boulder). J. Biol. Chem.; 248: No. 15, 5502-5511(10 Aug 1973).

The antibiotic rifampicin was used in an investigation of the temporal regulation of gene expression during bacteriophage T4 infection of Escherichia coli. Cells were uv irradiated prior to every infection and radiation effects were studied. At what times after infection the transcription of specific cistrons becomes rifampicin insensitive was studied. Gene expression was studied using analyses of proteins on sodium dodecyl sulfate-acrylamide gels; thus translation has been used to assay for the appearance of specific transcripts. Two types of promoters account for most prereplicative transcription; early promoters are recognized immediately after infection, whereas quasi-late promoters are recognized only after a delay of 1½ min. Those transcripts previously defined as immediate early and delayed early RNAs initially appear to be under the control of early promoters; however, the quasi-late promoters may provide a second mode of regulation for several of those transcripts. (auth)

9758 RADIATION RESISTANCE OF SPORES OF BACILLUS SUBTILIS AND B. STEAROTHERMOPHILUS AT VARIOUS WATER ACTIVITIES. Naernuiv, B. G.; Snygg, B. G. (Svenska Institutet foer Konserveringsforskning, Goteborg). J. Appl. Bacteriol.; 36: No. 4, 677-682(Dec 1973).

The radiation resistance of spores of Bacillus subtilis and B. stearothermophilus was determined under anoxic conditions in water vapor and in aqueous solutions of glucose and glycerol at various water activities. In water vapor, resistance of both kinds of spores increased slightly with decreasing water activity (a_w). In glycerol solutions, a phase of rapid increase in resistance with decreasing a_w was followed by a slower increase on further reduction of a_w. This second phase was almost parallel to the water vapor curve, which, however, showed considerably lower resistance. The initial phase of rapid increase in resistance was also observed in glucose solutions. (auth)

9759 EFFECT OF CYCLIC AMP AND SOME STRUCTURAL ANALOGUES ON THE DARK REPAIR INHIBITION BY CAFFEINE OF UV-IRRADIATED CELLS. Chandra, P.; Scheckel, R. E. O.; Wacker, A. (Univ., Frankfurt am Main). Radiat. Environ. Biophys.; 11: No. 1, 87-90(Mar 1974).

The effect of cyclic AMP and some structural analogs on the dark-repair inhibition by caffeine was studied in Escherichia coli. Cyclic AMP had no significant effect, contrary to the previous report by Wacker et al., on the dark-repair inhibition by caffeine. Some cyclic AMP derivatives, resistent to hydrolysis by the phosphodiesterase enzyme, were used to investigate the role of phosphodiesterase in dark-repair inhibition by caffeine. These derivatives, when added alone, had no activity on the dark-repair process. Experiments in combination with caffeine showed that

these derivatives were unable to reverse the dark-repair inhibition by caffeine. The present data do not support any correlation between the caffeine inhibition of the dark-repair process, and the phosphodiesterase involved in cyclic AMP metabolism. (auth)

Radiation Effects on Plants

Refer also to abstracts 9707, 9723, 12106, 12139, and 12146.

9760 (AECL-4668) ECOLOGY OF THE FIELD IRRADIATOR-GAMMA AREA. III. Revisions to Botanical Methods and Vegetation Sampling Procedures (AECL-4135). Dugle, J. R.; Thibault, D. H. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Feb 1974. 47p. Dep. NTIS (US Sales Only) $5.50. AECL $1.50.

The botanical field methods to be followed in the Field Irradiator-Gamma area (FIG) are described, with the principal method involving the use of sampling quadrats. Because this is a long-term successional study, all quadrats, plots and vegetation of special interest must be mapped and permanently marked. The parameters sampled, which include species numbers, diversity, and within-species changes will allow a comparison of pre- and post-irradiation levels. Revised methods are included. (auth)

9761 (CONF-720131-) MUTATION BREEDING WORKSHOP, JANUARY 17–18, 1972, KNOXVILLE, TENNESSEE. (Tennessee Univ., Knoxville (USA)). 1972. 36p. Dep. NTIS $5.00.

Abstracts of papers presented at the Mutation Breeding Workshop are included. The mutagenic agents discussed include ionizing radiations and chemical mutagens. (ERB)

9762 (COO-2085-8) PHYSICO-ECOLOGICAL STUDIES ON GAMMA IRRADIATED AND NON-IRRADIATED CLADONIA SYLVATICA (L.) HOFFM. Barstow, J. M. (Michigan Technological Univ., Houghton (USA)). 1974. Contract AT(11-1)-2085. 44p. Dep. NTIS $5.25.

Thesis.

The lichen Cladonia sylvatica appeared to be resistant to acute doses of radiation when field conditions were not favorable for growth. However, under conditions favorable for growth a dose of 10^6 rads caused minor macroscopic damage within a few weeks, and more extensive damage after a growing season. (CH)

9763 (EUR-5101) APPLICATION OF ATOMIC ENERGY IN AGRICULTURE. Annual Report, 1972. (Commission of the European Communities, Luxembourg; Instituut voor Toepassing van Atoomenergie in de Landbouw, Wageningen (Netherlands)). Feb 1974. 174p. Dep. NTIS (US Sales Only) $11.75. EUR B.Fr. 225.-.

Results are summarized from studies on uses of ionizing radiations in agriculture. Data are included on: uses of x radiation for the induction of mutants of potato plants following exposure of adventitious buds; the effects of fractionated x or fast neutron irradiation on metabolic activity in plant leaves; the effectiveness of irradiation, with or without heat treatment, for extending the storage life of peeled potatoes, fresh mushrooms, prepackaged onions and endive, prepackaged boiled fresh mussels, canned stew, and prepackaged dried meat; testing of the wholesomeness of a diet of irradiated and heat-sterilized foods in swine; the effectiveness of the sterile male technique for the control of the onion fly (Hylemya antiqua); the use of radioinduced mutants to improve the protein content of peas (Pisum sativum) and barley (Hordenum vulgare) and to develop a mildew-resistant strain of barley; use of radioisotopes as tracers in studies of plant metabolism, including ^{32}P to trace phosphate transport in soybeans (Glycine max), ^{45}Ca and ^{47}Ca to trace calcium uptake from soil by spinach (Spinacea oleracea) and tomato plants (Lycopersicon esculentum), and ^{15}N to trace nitrogen transport in soils. A list is included of 75 publications during the period covered by this report that present results of completed studies in detail. (CH)

9764 (IAEA-R-546-F) STUDIES ON THE EFFECTS OF NEUTRON IRRADIATION ON SEEDS. Part of a Coordinated Programme of Research on the Use of Neutrons in Seed Irradiation. Final Report, 1 December 1967–30 November 1971. Stoilov, M. (International Atomic Energy Agency, Vienna (Austria)). 1972. 11p. INIS.

Use was made of a standard neutron irradiation facility (SNIF), which was mounted at a core distance of 46.4 cm to the reactor IRT-2000. Dosimetry of neutron and gamma dose rates was done by means of ionization chambers (Mg-A and CH) and sulphur pellets. Dormant seeds of Himalaya barley containing 12% moisture were irradiated in the SNIF at 600 to 1800 rad doses. Some of the seeds were germinated immediately after irradiation, some were stored for 30 days as follows: in air at –5°C, in air at 20°C, or in nitrogen atmosphere at 20°C. It has been found that the neutron dose rate in the working volume of the facility is 22.4 rad/s and the contamination of the gamma-rays is 3.0 rad/s at a reactor power of 1000 kw. The conversion factor K is $4.35 \cdot 10^{-9}$ rad/n/cm^2. The neutron dose required for 50% growth reduction in seedling height was 1.2 krad. An RBE value of 34 was measured for chromosomal aberrations in barley and the value 29 was found for 50% growth reduction of the first leaf. Analysis of the chromosomal aberrations at anaphase indicates that storage of seeds in air for 30 days at 20°C results in an increase of chromosomal aberrations by 5 to 6% on the average. Storage at –5°C results in decrease of chromosomal aberrations rate by the same percentage, the differences being statistically significant at 5% level. Seeds stored at 20°C and –5°C show greatest differences with respect to fragments (over 7%). The differences observed for seeds stored at 20°C in air and in nitrogen atmosphere were not significant. It may be concluded that there is no oxygen effect following fast neutron irradiation. (INIS)

9765 (IAEA-R-617-F) IMPROVEMENT OF PROTEIN QUALITY IN SOYBEANS (GLYCINE MAX. L.) THROUGH MUTATION BREEDING. Part of a Coordinated Programme on the Use of Nuclear Techniques for Seed Protein Improvement. Final Report, 1 April 1968–30 September 1971. Santos, I. S. (International Atomic Energy Agency, Vienna (Austria)). May 1972. 7p. INIS.

The Lincoln variety soybean was developed from a cross between Mandarin and Manchu varieties and used as starting material. Its desirable characters include almost non-shattering pods; responsiveness to improved soil conditions; almost complete insensitivity to photoperiod at latitudes of about 12°; vegetative thriftiness. The seeds contain 21.7% oil and 39.5% protein. Breeder's seeds of the variety were irradiated with thermal neutrons in doses from 2×10^{11} to 7.5×10^{13} n_{th}/cm^2 and in another experiment with fast neutrons. Varieties CES 434 and L 114 were exposed to ^{60}Co gamma rays at dose levels of 10, 20, 40, and 60 Kr. Plant height and survival date were measured 15 days and 26 days after sowing, respectively. A portion of the bulked harvest from each M_2 row was planted in an observational nursery. Putative mutants for high yield selected from nursery were grown in a preliminary test. This failed due to continuous rains after sowing. Another test three months later failed due to poor germination. Screening of plant material in later generations was carried out with the Udy method. Positive identification of soybean mutants with significantly better protein quality and/or adaptability was hindered by unusually poor weather, lack of suitable experimental land, and poor experimental design. (INIS)

9766 (IAEA-R-748-F) RESEARCH WITHIN THE COORDINATED PROGRAMME ON THE USE OF NEUTRONS IN SEED IRRADIATION. Final Report, 1 March 1969–30 April 1971. Hamann, H. J. (International Atomic Energy Agency, Vienna (Austria)). Apr 1972. 1p. INIS.

The effects of 3.4-MeV and 14.7-MeV neutrons on seeds of Hordeum vulgare and Vicia faba were compared. The neutrons were produced by the reactions $^2H(d,n)^3He$ and $^3H(d,n)^4He$ using a 600-keV cascade accelerator. Biological response was measured in terms of growth inhibition and frequency of chromosome aberrations. As a measure of effectiveness R(E) (E = neutron energy in MeV) in the case of growth inhibition, the constant reactivity of the exponential part of the dose effect curve was used and in the case of aberration induction, the aberration frequency per unit dose. The ratio R(14.7)/R(3.4) of the effectivenesses for the two neutron energies is: 1.0, 0.93, 0.92, 1.1, 0.93 in the case of growth inhibition of the first leaf of barley, frequency of double bridges in barley root tips, growth inhibition of the main root of Vicia faba, frequency of double breaks, and fraction of aberrant cells in Vicia faba root tips respectively. The ratio is almost independent of the observed effect and about equal to the ratio 0.85 of quality factors. A comparison was made between the biological effects of 3.4-MeV and 14.7-MeV neutrons on the survival of Aspergillus niger and Funaria hygrometrica spores. The energy dependence of the neutron effects has been described as the ratio of the effectivenesses for the two neutron energies R(14.7)/R(3.4). The numerical values of this ratio are 0.63 and 0.35 for the survival of A. niger and F. hygrometrica respectively. (INIS)

9767 (IAEA-R-749-F) MUTATION BREEDING OF SOYBEANS FOR RESISTANCE TO RUST DISEASE. Part of a Coordinated Programme on Mutation Breeding for Disease Resistance. Final Report, 1 March 1969–28 February 1972. Lu, Y. C. (International Atomic Energy Agency, Vienna (Austria)). Jun 1972. 5p. INIS.

The purpose of the project was to obtain mutant genotypes resistant to the rust disease (Phakopsora pachyrhizi) in soybeans. Seeds of six different varieties were irradiated with 15, 20, 25 and 30 KR of gamma rays. A treatment with the chemical mutagen EMS (0.1%) was also included. The treated material was

grown in 1969, spring season. The M_1 population consisted of 1500 plants per treatment. Selections for rust resistant mutant plants were made in M_3- and M_4-generations. The selected plants were propagated and the mutant lines were tested for rust resistance under field conditions in 1971 and 1972 during three seasons (spring, summer, and fall) at three locations. Eight mutants have shown repeatedly high resistance against rust and the trials in the spring season 1972 should hopefully bring conclusive results. (INIS)

9768 (IAEA-R-900-F) FIELD AND PHYTOTRON EXPERIMENTS ON RADIOSTIMULATION OF SOME GRAIN AND VEGETABLE VARIETIES. Final Report, 1 April 1970–31 March 1972. Simon, J. (International Atomic Energy Agency, Vienna (Austria)). 1972. 101p. INIS.

During 1970 and 1971, studies were carried out on early red radish and tomato (variety Kecskeméti torpe mainly used for canning industry) grown in phytotron, greenhouse, water culture, and in the field, to find out whether and under what conditions significant positive and reproducible stimulation effect(s) could be observed as a result of low-dose γ irradiation of seeds. While the fresh weight of radish root, as well as that of tomato fruits, showed a significant increase for a number of treatments, the dry weight was never increased significantly as a result of low dose irradiation of seeds. This fact is of prime importance, and indicates that the often observed stimulation effect is due to higher moisture content of radish root or tomato fruits. Further investigations, preferably under controlled conditions, are needed. (INIS)

9769 (IAEA-R-1032-F) USE OF PHYSICAL AND CHEMICAL MUTAGENS TO INDUCE DISEASE RESISTANT MUTATIONS IN RICE. Part of a Coordinated Programme on Induced Mutations for Disease Resistance in Crop Plants. Final Report, 1 July 1971–30 June 1972. Woo, S. C. (International Atomic Energy Agency, Vienna (Austria)). Aug 1972. 12p. INIS.

The project was initiated in July 1971 and three different approaches were tried: to treat moderately resistant rice varieties to raise their level of resistance; to treat introduced highly resistant varieties to improve their adaptability to local climatic and agronomical conditions; and to employ anther culture techniques to breed homozygous lines from indica x japonica hybrids with resistance to blast and bacterial blight. The improvement of other characteristics such as earliness, semidwarf stature, etc. were also considered. So far the following results have been obtained: 74 mutant lines resistant to blast were selected in the blast nursery from the mutagen treated variety Chisnung 242. Four resistant mutants were rescued from a disease nursery under upland conditions. In mutagen treated IR8, six mutants with increased susceptibility to leaf blight were observed. The work is being continued. (INIS)

9770 (IAEA-R-1127-F) USE OF RADIATION INDUCED MUTANTS IN RICE BREEDING AND PRODUCTION. Part of an FAO/IAEA Coordinated Programme. Final Report, 1 January 1972–31 December 1972. Ando, A. (International Atomic Energy Agency, Vienna (Austria)). Dec 1972. 3p. INIS.

The work carried out under RC 1127 is a continuation of the research undertaken under RC 476 with more direct emphasis on mutation efficiency of combined radiation and chemical treatments on characters of practical agronomic value such as early maturity and culm length (plant height). On the basis of the observations from one year's experiments no definite conclusions can be drawn. (INIS)

9771 (SRO-637-3) DEVELOPMENT OF NEW TECHNIQUES OF USING IRRADIATION IN THE GENETIC IMPROVEMENT OF WARM SEASON GRASSES AND ASSESSMENT OF THE GENETIC AND CYTOGENETIC EFFECTS. Progress Report, August 1, 1973–April 30, 1974. Burton, G. W.; Hanna, W. W. (Georgia Univ., Tifton (USA). Georgia Coastal Plain Experiment Station). [nd]. Contract AT(38-1)-637. 90p. Dep. NTIS $7.50.

Progress is reported in the development of irradiation techniques for use in crop breeding programs. Data are included from studies on the production and nutritional quality of silage from pearl millet, sorghum, and corn grown from seeds exposed to low doses of γ radiation; the use of radioinduced mutants in the breeding of bermudagrass and coastcross-1, a forage grass hybrid, to increase winter hardiness and resistance to nematode infestation; heterosis resulting from crossing radioinduced mutants of corn with normal inbred parents; the induction of pearl millet mutants following exposure of pollen to thermal neutrons; and cytogenetic studies of induced mutants of pearl millet (Pennisetum typhoides). A list is included of publications that report the results of completed studies. (CH)

9772 (TID-26113) ENTERPRISE, WISCONSIN, RADIATION FOREST: PREIRRADIATION ECOLOGICAL STUDIES. Rudolph, T. D. (ed.). (Forest Service, Rhinelander, Wis. (USA). North Central Forest Experiment Station). 1974. 158p. Dep. NTIS $7.60.

The experimental design of the Enterprise Radiation Forest, Wisconsin, is described. Results are reported from a preirradiation ecological study of the site. Data are included on the vegetation composing the forest communities, solar radiation measured in the open and under tree canopies, litter production by individual tree species, and the vertebrate population of the forest. The first site was irradiated during the 1972 growing season and an attempt was made to predict the effects of chronic γ irradiation on the forest community. (CH)

9773 ENHANCEMENT BY CAFFEINE OF THE FREQUENCIES OF CHROMOSOMAL ABERRATIONS INDUCED IN PLANT AND ANIMAL CELLS BY CHEMICAL AND PHYSICAL AGENTS. Kihlman, B. A.; Sturelid, S.; Hartley-Asp, B.; Nilsson, K. (Royal Agricultural Coll. of Sweden, Uppsala). Mutat. Res.; 26: No. 2, 105-122(Apr 1974).

From symposium on caffeine as an environmental mutagen and the problem of synergistic effects; Uppsala, Sweden (5 Jun 1973).

Caffeine potentiation of induced chromosome damage was studied. The results are presented and discussed under four major headings: the dependence of the potentiation on (1) the type of chromosome-breaking agent, (2) the type of material, (3) the molecular structure of the potentiating agent, and (4) environmental and metabolic factors. The frequencies of chromosomal aberrations produced in plant and animal cells by maleic hydrazide (MH), 4-nitroquinoline-1-oxide (4NQO), ultraviolet irradiation and a number of mono- and poly-functional alkylating agents was dramatically increased by post-treatments with caffeine. Results with maleic hydrazide indicate that, for this type of agent, potentiation is obtained only when the cells are exposed to caffeine during the S-phase. The chromosome damage produced by x-rays in bean roots was increased by post-treatments with caffeine when cells were irradiated in G_2 or prophase, but not in G_1 or S. Bleomycin (BLM)-induced chromosome damage was increased by caffeine both in G_2-prophase cells and in S cells. Caffeine potentiation of thiotepa-induced chromosome damage was obtained in root tips of Vicia faba and Allium proliferum as well as in cell cultures of the Chinese hamster. No potentiation was obtained in the human cell line LU_{106}. Post-treatments with methylated oxypurines did not produce any marked change in the proportions of the various types of aberration, but merely increased the frequencies of the aberrations characteristic of the thiotepa effect in plant and animal cells. The relative activities of the methylated oxypurines differed depending on the material. Eight methylated oxypurines were tested for their ability to potentiate the chromosome damage produced by thiotepa in Chinese hamster cells and in bean (Vicia faba) roots. In the latter material caffeine produced the strongest potentiation, whereas in Chinese hamster cells, caffeine was surpassed by 8-chlorocaffeine (CC) with regard to potentiating activity. Tetramethyluric acid (TMU) was almost inactive in both materials. In bean roots a 5-h post-treatment with $2.5 \cdot 10^{-3}$ M caffeine produced an almost 8-fold increase of the thiotepa-induced aberration frequency when given at 25° and 5 h after thiotepa. A similar caffeine post-treatment given at 10° was practically without effect. In contrast, caffeine potentiation of the chromosome damage produced by MH, azaserine, and methyl methanesulphonate (MMS) was almost as strong when roots were exposed to caffeine at 10° as when they were exposed at 25°. (auth)

9774 EFFECT OF CAFFEINE ON CHROMOSOME DAMAGE INDUCED BY CHEMICAL MUTAGENS AND IONIZING RADIATION IN VICIA FABA AND SECALE CEREALE. Swietlinska, Z.; Zuk, J. (Inst. of Biochemistry and Biophysics, Warsaw). Mutat. Res.; 26: No. 2, 89-97(Apr 1974).

From symposium on caffeine as an environmental mutagen and the problem of synergistic effects; Uppsala, Sweden (5 Jun 1973).

The potentiating effect of caffeine on chemically induced chromosome aberrations was studied in Vicia root tips exposed to maleic hydrazide (MH), difunctional alkylating agent diepoxybutane (DEB) and two monofunctional ones, N-ethyl-N-nitrosourea (ENU) and methyl methanesulphonate. Aberrations induced by MH and DEB were strongly potentiated by caffeine post-treatments; the effect was noted even when the time between the mutagen and caffeine treatment was considerably prolonged. The data obtained suggest that cells exposed to these mutagens are most sensitive to caffeine during their first passage through the S-phase. Induction of aberrations by ethyl methanesulfonate (EMS) and ENU were also highly potentiated by caffeine post-treatment. However, following EMS treatment the potentiating effect of caffeine was observed already after 20 h of recovery while after ENU treatment this effect was delayed up to 30 h. The yields of aberrations induced by x- and γ-rays in Vicia were not significantly increased by caffeine pre- or post-treatments. This was true both for the damage induced in seeds by x- and γ-rays and for chromatid-type aberrations

induced by x-rays in root tips. In contrast to Vicia the yield of aberrations induced by x rays in rye seeds was significantly increased by caffeine post-treatment. (auth)

9775 REPAIR PROCESSES IN GERMINATING SEEDS: CAFFEINE ENHANCEMENT OF DAMAGE INDUCED BY GAMMA RADIATION AND ALKYLATING CHEMICALS. Ahnstroem, G. (Univ. of Stockholm). Mutat. Res.; 26: No. 2, 99-103(Apr 1974).

From symposium on caffeine as an environmental mutagen and the problem of synergistic effects; Uppsala, Sweden (5 Jun 1973).

The resistance of resting seeds to γ-rays indicates that efficient repair processes take place early during germination. To elucidate this problem we have tried to increase the radiation-induced damage by treating the germinating seeds with compounds believed to interfere with the repair of damage to the genetic material. One such compound found to be effective was caffeine. Caffeine increased the γ-ray-induced damage by a factor of two, if present during the first 5 h of germination. The treatment also doubled the frequency of chromosomal aberrations. (ERB)

9776 RADIATION EFFECTS AS DEPENDENT ON VARIOUS DOSES OF GAMMA RAYS AND THE MOISTURE CONTENT OF CUCURBITA MAXIMA DUCH. SEEDS. Goranov, A. God. Sofii. Univ., Biol. Fak.; 64: No. 2, 195-225(1972). (In Bulgarian).

Dry and imbibed seeds of Cucurbita maxima Duch, Edra byala 48/4 cultivar, have been irradiated with gamma-rays at rates 500, 1000, 2000, 3000, 4000, 5000, 10,000, and 50,000 R and have been experimented for 3 years. It has been shown that wetting raises the radiosensitivity of seeds. A dose of 4000 R applied to dry seeds stimulates stem growth, leaf number and ramification, weight, and sugar content of fruits; the same effects are exerted by a dose of 3000 R applied to imbibed seeds. Doses of 50,000 and 10,000 R, resp., are inhibitory, while 50,000 R is lethal to wetted seeds. Concerning dry seeds, gamma radiation does not have a substantial effect on the weight and number of produced seeds. On the other hand, with wetted seeds it inhibits the seed formation. (INIS)

9777 EFFECT OF GAMMA TREATMENT OF SEED ON CERTAIN PHYSIOLOGICAL REGULARITIES AND YIELD OF ONION. Genchev, S.; Todorov, J. Gradinar. Lozar. Nauka; 9: No. 7, 85-91(1972). (In Bulgarian).

Investigations on gamma-irradiation of seeds as influencing some physiological peculiarities and yield of onion grown as an annual crop were performed in 1969-1970. Irradiation was experimented in doses of 500, 1000, 1500, 2000, and 2500 R. Plants of Pioneer and Trimontium cultures grown in the open were tested. Pre-sowing gamma-irradiation of onion seed affects the yield differently: in 1969 a tendency towards a positive while in 1970 towards a negative effect, was observed. Irradiation at the rate of 1500 R brings about an insignificant increase in the total pigment content (chlorophyll plus carotenoids) and in a chlorophyll content while rates of 500 and 2000 R caused an unsubstantial decrease in the amount of these pigments. Inconsiderable changes were found also in the ratios between chlorophyll a and chlorophyll b, on the one hand, and between the chlorophyll and carotenoids, on the other, as a result of irradiation seed treatment. (auth)

9778 EFFECT OF PRE-SEEDING GAMMA-IRRADIATION ON THE NUMBER OF LEAVES, SUGAR CONTENT, AND SEED COLOR IN CUCURBITA MAXIMA DUCH. Goranov, A. God. Sofii. Univ., Biol. Fak.; 64: No. 2, 171-183(1972). (In Bulgarian).

Dry seeds of Cucurbita maxima Duch. Edra byala 48/4 cultivar, were treated with gamma rays at rates of 500, 1000, 2000, 3000, 4000, 5000, 10,000, and 50,000 R in two-year tests. It was found that gamma rays affect the leaf number stimulatively—at 4000 R and inhibitorily—at 50,000 R. The percentage of sugar content of fruits and seed color are also affected. (INIS)

9779 INFLUENCE OF ^{60}Co γ IRRADIATION ON CARROT SEEDS. II. Qualitative and Quantitative Investigations on Carotenes in the Harvested Crop. Bancher, E.; Riederer, P.; Washuetti, J. (Technische Hochschule, Vienna). Angew. Bot.; 47: No. 5/6, 199-204(1973). (In German).

In carrots grown from γ-irradiated seeds, α, β, γ, and delta-carotene were identified; oxygen containing carotenoids were absent. No change in the composition of the carotenes could be traced after γ irradiation. The average content of α, β, γ, and total carotenes of carrots of an early and late harvest as well as after one or two months' storage disclosed effects produced by the γ irradiation of carrot seeds. In the controls and plants from seeds irradiated with up to 11 krad, the α-carotene content reached its highest value at the early harvest; in plants from seeds irradiated with higher doses the maximum α-carotene content was reached at the late harvest stage. β- and γ-carotene attained their maximum values in plants grown from irradiated seeds at late stages (second harvest time and stored roots). In field experiments γ irradiation of seeds often caused very low germination rates and a delay of growth. (auth)

9780 MUTAGENIC EFFECT OF GAMMA RAYS, CHEMICAL MUTAGENS, AND COMBINED TREATMENTS IN SORGHUM. Ramulu, K. S. (Agricultural Coll., and Research Inst., Coimbatore, India). Z. Pflanzenzuecht.; 70: No. 3, 223-229(Nov 1973).

The effect of gamma rays, chemical mutagens (EMS, MMS, and DES) and combined treatments on survival, seedling growth, and seed fertility in the M_1 and frequency and spectrum of chlorophyll mutations in the M_2 was studied in a cultivated grain sorghum. The combined treatments caused no additive effects in reducing survival or seedling growth or seed fertility in the M_1. In the M_2 the combination treatments of gamma rays and EMS alone gave an additive frequency of chlorophyll mutations. There was no increase in the spectra of chlorophyll mutants following combination treatments. The combined treatments of gamma rays and EMS gave more than additive efficiency values when estimated on sterility basis. (auth)

9781 WHOLESOMENESS OF HIGH CONCENTRATIONS OF FREE RADICALS IN IRRADIATED FOODS. Renner, H. W.; Reichelt, D. (Bundesforschungsanstalt fuer Lebensmittelfrischaltung, Karlsruhe, Ger.). Zentralbl. Veterinaermed., Reihe B; 20: No. 8, 648-660(Oct 1973). (In German).

A diet containing 35% of irradiated milk powder (4.5 Mrad) with a high content of long-lived free radicals was tested with rats using six generations (456 animals) in a 3-year longterm feeding study for chronic toxicity. The following parameters were studied: growth, food efficiency, intake of digestible protein, hematological investigations, electrophoretic separation and determination of serum protein fractions, total protein, serum enzyme activities (GPT, GOT, AP, SDH), bone marrow smears, urine tests, organ weights (heart, liver, kidney, spleen), body weights and gross pathology, histopathology of organ slices (lung, liver, spleen, kidney, adrenals) and of all tumors, measurements of chronaxy, fertility, litter size, litter weight, and weaning ratio. Significant differences between the diet-groups were found only with respect to body weights after one year of feeding, probably caused by suboptimal vitamin supply in the experimental group. These differences disappeared during the second year of feeding. This study gave no indication of chronic toxic or carcinogenic effects of an irradiated diet with a high content of free radicals. (auth)

9782 RADIOMIMETIC ACTIVITY OF A NEW ANTIBIOTIC, ACTINONIN. Kaul, B. L.; Singh, C. (Regional Research Lab., Jammu, India). Sci. Cult. (Calcutta); 39: No. 11, 517-518(Nov 1973).

The radiomimetic activity of a new antibiotic, actinonin, is reported. The test material consisted of dormant seeds of rye (Secale cereal) and barley (Hordeum vulgare). For each treatment 25 seeds were taken in a conical glass flask to which was added 20 ml of the test solution. The treatments were carried out in duplicate at a constant temperature of 22°C for 20 hrs. The treated seeds were subsequently planted on moist filter papers in glass Petri dishes for germination. Root tips in their first mitosis were examined for abnormal cells and chromosome aberrations. (CH)

9783 EFFECT OF IONIZING RADIATIONS ON DRY MATTER PRODUCTION AND PIGMENT CONTENT IN RICE SEEDLINGS. Bhan, A. K.; Kaul, M. L. H. (Kurukshetra Univ., India). Sci. Cult. (Calcutta); 39: No. 11, 511-513(Nov 1973).

Seeds of two varieties of rice with 13% moisture content were irradiated with 20, 25, and 30 Kr γ rays with a ^{60}Co source and 200 seeds from each treatment, along with control sets, were sown in nursery beds and the shoot and root length of seedlings was recorded 30 days after sowing. Data are presented on the dry matter content and pigment content of seedlings. (CH)

9784 STATISTICAL EVALUATION OF DOSE-RESPONSE FUNCTIONS Kellerer, A. M.; Brenot, J. (Columbia Univ., New York). Radiat. Environ. Biophys.; 11: No. 1, 1-13(Mar 1974).

The linear-quadratic dependence of effect on the dose of ionizing radiation and its biophysical implications are considered. The estimation of the parameters of the response function and the derivation of the joint confidence region of the estimates are described. The method is applied to the induction of pink mutations in Tradescantia, which follows the linear-quadratic model. The statistical procedure is also suitable for other response functions. (auth)

9785 EFFECT OF GAMMA RADIATION ON SOME MEMBERS OF ACANTHACEAE. Kaur, J.; Nizam, J. (Osmania Univ., Hyderabad, India). J. Indian Bot. Soc.; 51: No. 3, 226-231(1972).

Seed material belonging to seven genera of Acanthaceae was subjected to gamma irradiation at two different intensities -55 rads/min and 25 K rads/min being the dose rate for low and high intensity irradiation respectively. The effect of low intensity irradiation in acute as well as fractionated doses, and high-intensity irradiation was observed. The effect of storage on seeds treated

with high-intensity irradiation was also noted. Barleria prionitis is the most sensitive to irradiation. This species has the highest chromosome number and the largest chromosomes among the species investigated. From the seeds treated with high-intensity irradiation, only a few seeds of Rhyticalymma glaucum and Asteracantha longifolia treated at the lowest dose i.e., 10,000 rads, germinated and survived up to maturity. There was, however, no abnormality in the meiotic behavior of the pollen mother cells of the surviving plants. (auth)

9786 INVESTIGATION OF THE RIPE FRUITS OF CUCURBITA MAXIMA DUCH., GROWN FROM SEEDS PRESOWING TREATED WITH GAMMA RAYS AND SUBJECTED TO POST-IRRADIATION TREATMENT. Goranov, A. God. Sofii. Univ., Biol. Fak.; 65: No. 2, 173-186(1972). (In Bulgarian).

The ripe fruits of Cucurbita maxima Duch. cultivar Edra byala $^{45}/_{4}$, grown from seeds irradiated prior to sowing with 4,000 and 50,000 R gamma rays and treated postirradiation with temperatures of up to +80°C and +90°C for 30 min. were investigated in 1968 to 1970 in field trials. It was demonstrated that the presowing postirradiation treatment at +80°C for 30 min produces a stimulating effect on the number of fruits per plant but has no essential effect on the weight of fruit. Radiation at 4,000 R stimulates the number of fruits per plant and increases the weight of fruit, while that of 50,000 R exerts inhibition in both cases. Presowing postirradiation temperature treatments remove these stimulating and inhibiting effects. The percent of dry substances (saccharose) per ripe fruit increases with the increase of temperature treatment, on the one hand, and the rise of the irradiation dose from 4,000 to 50,000 R, on the other. However, the presowing postirradiation temperature treatment does not affect the radiation stimulation of the percent of dry substances (saccharose) per ripe fruit. (auth)

9787 EFFECTS OF DIFFERENT MUTAGENS ON SELF-INCOMPATIBILITY IN NICOTIANA ALATA LINK AND OTTO. I. Chronic Gamma Irradiation. van Gastel, A. J. G.; De Nettancourt, D. (Instituut voor Toepassing van Atoomenergie in de Landbouw, Wageningen, Netherlands). Radiat. Bot.; 14: No. 1, 43-50(Apr 1974).

An analysis was made of the efficiency of chronic gamma irradiation for inducing mutations at the S-locus of the self-incompatible species Nicotiana alata. A clonal population derived from a single S_2S_3 individual was exposed, at the flowering stage, to different dose rates of gamma rays ranging from 0.3 to 14.3 rad/hr. With a daily interruption of 3 hr irradiation was continuous and lasted 3 months. In all, more than 25 million pollen grains were screened, via repeated self-pollination in the irradiated populations for either self-compatibility mutations or new specificities. Whereas the results obtained clearly indicated that chronic irradiation was very effective for inducing seed set upon selfing, only one unequivocal mutant could be recorded among the M_2 progenies. This mutant produced compatible pollen and clearly displayed a centric fragment. Not a single case of a new specificity at the S-locus could be detached. These results are compared to those that have been obtained elsewhere after acute exposure to x rays and the conclusion is reached that chronic irradiation is far less effective than acute treatment for inducing self-compatibility mutations. The apparent incapacity of both chronic and acute irradiation to generate new self-incompatibility alleles is discussed in relation to the spontaneous occurrence of such mutations in inbred populations. (auth)

9788 EFFECT OF SODIUM FLUORIDE ON RADIATION SENSITIVITY OF BARLEY SEEDS. Jagannath, D. R.; Bhatia, C. R. (Bhabha Atomic Research Centre, Bombay). Mutat. Res.; 23: No. 1, 51-56(Apr 1974).

Barley seeds soaked in 0.01 M sodium fluoride (NaF) in phosphate buffer (pH 7) or in buffer alone for 18 h were dried and equilibrated to 10% moisture, either in air or in nitrogen. Pretreated and re-dried seeds were irradiatedin air or in nitrogen with 0, 13, 20, 26, and 32 kR of γ rays, and were immediately hydrated in oxygen- or nitrogen-bubbled water. Parameters of radiation effect considered were seedling injury, mitotic and meiotic cells with bridge aberrations at anaphase and pollen fertility in M_1, and the frequency of chlorophyll mutations in M_2. NaF at 0.01 M was not mutagenic by itself. Pre-treatment with NaF significantly enhanced the radiation effect, when the irradiation was done in air, in comparison with the buffer soaked seeds. The increased effect due to NaF was additional to the oxygen effect. In nitrogen, NaF pre-treatment increased the mutagenic effect but it was not always significant. Post-soaking of irradiated seeds in 0.01 M NaF for 5h increased seedling injury in comparison with the irradiated seeds soaked in buffer alone or in 0.01 M NaCl. At least a part of the sensitizing effect of NaF may be due to the inhibition of repair. (auth)

9789 STUDIES ON THE IDENTIFICATION OF IRRADIATED POTATOES. V. Calorimetric Determination of Catalase. Penner, H. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). Z. Lebensm.-Untersuch. Forsch.; 154: No. 1, 23-26(Jan 1974). (In German).

A method for calorimetric determination of catalase in potato extracts was developed. The activity of catalase is measured in a calorimeter by electronic recording of the temperature course of hydroperoxide decomposition and evaluation by a programmable calculator. A significant effect of 15-krad electron irradiation was not observed in potatoes of the variety Sieglinde, neither in fresh tissue nor after 5 days of incubation. A comparative study of 5 more varieties showed a broad variation of catalase activity with the variety. (GE)

9790 MUTATION VARIABILITY OF COTTON, INDUCED BY THE ACTION OF PHYSICAL AND CHEMICAL MUTAGENS. Kuliev, A. M.; Guseinov, I. I. Tsitol. Genet.; 8: No. 1, 41-44 (1974). (In Russian).

It is established that irradiation of unripe 40- and 50-day seeds with γ rays in the dose of 10,000 R and the treatment of the seeds at the same age with 0.03% solution of ethylenimine for 20 h is one of the efficient ways for intensifying the frequency of variability and mutability of the cotton plants varieties C-4727 and 108-F from the species G. hirsutum L. and MOS-620 from the species G. barbadense L. In the above-mentioned variants, a greater amount of economically valuable mutations is obtained in M_3 than in the control and 30-day seeds. (auth)

9791 APPARENT NON-INVOLVEMENT OF GROWTH HORMONES IN THE INDUCTION BY RADIATION OF TUMOROUS OUTGROWTHS IN OSMUNDA PROTHALLI. Howard, A.; Haigh, M. V. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Radiat. Bot.; 14: No. 1, 59-61(Apr 1974).

Prothalli of Osmunda regalis were x-irradiated to produce tumorous outgrowths. Treatment on days 1 to 3 or 4 to 7 after irradiation with indole butyric acid at concentrations from 10^{-8}M up to toxic levels had no effect on the radiation response. Treatment of unirradiated 21-day-old prothalli with 2, 3, 5- triiodobenzoic acid at concentrations up to 5×10^{-5}M had no effect on growth pattern: at 10^{-4}M some prothalli were killed but no growth aberrations were seen. The conclusion is that these growth hormones are not involved in the appearance of radiation-induced tumorous outgrowths in Osmunda prothalli. (auth)

9792 EFFECT OF COBALT-60 GAMMA RAYS ON TERRESTRIAL MICROCOSM METABOLISM. Campbell, S. D. Ann Arbor, MI; Univ. of Michigan (1973). 153p. University Microfilms Order No. 74-3590.

Thesis (Ph. D.).

A method for investigating the effects of radiation on populations and ecosystems is described. Terrestrial microcosms or microecosystems were used as radiological test units to study radiation effects. The purpose of the study was to investigate terrestrial microcosm metabolism in terms of natural ecosystem development and to determine whether acute doses of ionizing radiation would produce a measurable response in microcosm metabolism. This study was conducted over a 200-day period. Eight 4-liter terrestrial microcosms were established from a parent ecosystem consisting primarily of Kentucky bluegrass (Poa pratensis) and crabgrass (Digitaria sanguinalis). The systems were maintained in a partially controlled environmental chamber during the study period. A number of preliminary experiments were conducted, prior to the 200-day study, to develop equipment and techniques and to establish conditions for the latter study. Net photosynthesis, nighttime respiration, the net photosynthesis/nighttime respiration ratio and gross photosynthesis were the metabolic parameters used to monitor and assess microcosm development. All eight microcosms were used to establish the pattern of development during the first 77 days of the study. Pairs of microcosms were then exposed to cobalt-60 gamma radiation; the treatment pairs received 1000, 20,000 or 40,000 rads. Two microcosms were maintained as controls. Post-irradiation metabolism was then monitored for 120 days. Short-term experiments were also conducted to determine the influence of moderate changes in input CO_2 concentration, light intensity and temperature on microcosm metabolism. An immediate but temporary effect was observed on the metabolic parameters at the two higher doses. Nighttime respiration was increased and net photosynthesis was decreased for several days following irradiation. The effect on nighttime respiration was greater than on net photosynthesis but neither was as great as that caused by an accidental temperature stress several weeks before. There was no significant long-term effect on nighttime respiration. A delayed effect on net photosynthesis was observed, however. Net photosynthesis was significantly lower than the controls in the systems which received the 20,000 and 40,000 rad treatments. Net photosynthesis was significantly higher in the microcosms which received 1000 rads, than in the controls, suggesting a possible stimulation effect. It was concluded that ter-

restrial microcosms exhibit the same pattern of metabolic development as terrestrial ecosystems and aquatic microcosms, both under normal conditions and conditions of stress. Precise control of laboratory variables was not required to detect the radiation effects in this study. Having been demonstrated useful as a radioecological test system, additional exploration of terrestrial microcosms as a general ecological tool is recommended. (Diss. Abstr. Int., B)

Radiation Effects on Animals

Refer also to abstract 12148.

9793 (AEC-tr-7457) BIOLOGICAL EFFECTS OF RADIATION FROM EXTERNAL AND INTERNAL SOURCES. Moskalev, Yu. I.; Kalistratova, V. S. (eds.). 1972. Translation of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972. 515p. Dep. NTIS $13.60.

Separate abstracts were prepared for the 67 papers included. (CH)

For abstracts of individual papers see: 9214, 9215, 9707, 9850–9862, 9943, 9951–9977, 9985, and 10000–10021.

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Refer also to abstracts 9131, 9162, 9502, 9526, 9558, 9707, 9710, 9879, 10148, 10314, 10514, 11698, 11700, 12062, and 12065.

9794 (BARC-739) DIVISION OF RADIOLOGICAL PROTECTION ANNUAL PROGRESS REPORT FOR 1973. Gangadharan, P.; Madhvanath, U.; Mishra, U. C. (Eds.). (Bhabha Atomic Research Centre, Bombay (India)). 1974. 139p. Dep. NTIS (US Sales Only) $10.00.

Radiation protection programs during 1973 for personnel in medicine, industrial, agricultural, and research institutions in India using radioisotopes or radiation sources are reviewed. Methods to reduce the radiation dose to patients during diagnostic radiography were investigated. Gamma sources (^{137}Cs and ^{60}Co) used for radiotherapy were calibrated. Design modifications were made in radiation detectors and dosimeters to improve efficiency. Radiological protection standards were developed and training sessions in radiation protection were held. A list is included of 57 publications that report the results of studies completed during the period covered by this report. (CH)

9795 (BARC/I-219) SUMMARY OF PERSONNEL RADIATION EXPOSURES IN BARC FOR THE YEAR 1971. Watamwar, S. B.; Unnikrishnan, M.; Mogal, M. P. (Bhabha Atomic Research Centre, Bombay (India)). 1972. 22p. INIS.

A summary of personnel radiation exposures for radiation workers of Bhabha Atomic Research Centre during the year 1971 is presented. There were only two cases of annual cumulative whole body dose exceeding 5 rem, the maximum being 6.2 rem. From the fortnightly significant overexposure readings, 12 whole body cases with a dose exceeding 1 rem, 14 skin cases with dose of 3 rem, and 6 extremities with a dose of 6 rem were observed. Whole body counting data showed that no radiation worker received more than one maximum permissible body burden of any detected isotope. The highest body burden recorded during this period for ^{131}I was 120 nCi (i.e. 0.002 of MPBB). There was no internal exposure exceeding one tolerance for any detected isotope. The highest internal dose recorded for any detected isotope was 0.3 tolerance. (auth)

9796 (GSF-K-77) AUTHORIZED PHYSICIAN AND HIS PRESENT AND FUTURE FUNCTION WITHIN THE FRAMEWORK OF MEDICAL HEALTH PHYSICS. Moehrle, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). Jul 1973. 30p. (In German). INIS.

Within the framework of medical education in the field of health physics and further training in order to become a so-called authorized physician, the experience gained up to now in the medical supervision of occupationally radiation exposed personnel is outlined in detail and a comprehensive presentation and a critical evaluation are given. (GE)

9797 (LA-5535-C, pp 166-177) USE OF MU-MESIC X RAYS AS A MEDICAL DIAGNOSTIC TOOL. Hutson, R. L. (Los Alamos Scientific Lab., NM). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

The spectrum of x rays emitted when negative muons are captured in tissue provides information about the chemical composition of the tissue. Such an approach to tissue chemical analysis has potential clinical applications. There are several accelerator laboratories where there will be negative beams of sufficient intensity to be of possible usefulness as a medical diagnostic tool. Those laboratories are LAMPF at Los Alamos, New Mexico; TRIUMF in Vancouver, British Columbia; and SIN near Zurich, Switzerland. Preliminary investigations of chemical analysis with negative muons carried out for diagnosis and for monitoring of physiological changes in patients are discussed. (CH)

9798 (N-74-15521) SPACE SHUTTLE PAYLOAD PLANNING WORKING GROUPS. Volume 4. Life Sciences. Final Report. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). May 1973. 76p. (NASA-TM-X-69406). NTIS $6.00.

The findings of the Life Sciences working group of the space shuttle payload planning activity are presented. The objectives of the Life Sciences investigations are: to continue the research directed at understanding the origin of life and the search for extraterrestrial evidence of life, biomedical research to understand mechanisms and provide criteria for support of manned flight, technology development for life support, protective systems and work aids for providing environmental control, and to study basic biological functions at all levels or organization influenced by gravity, radiation, and circadian rhythms. Examples of candidate experimental schedules and the experimental package functional requirements are included. (auth)

9799 (NP-19995) RADIOLOGICAL HEALTH IN THE GENESEE REGION. (Genesee Region Health Planning Council, Rochester, N. Y. (USA). Environmental Health Planning Committee). Oct 1973. 124p.

An environmental task force was formed to examine those sources of ionizing and non-ionizing radiations which pose a potential health problem to the population in the ten-county Genesee Region of New York. Occupational radiation exposures were excluded. Consideration was given to all of the sources of radiation considered to be of importance in the ten-county area. The radiation levels from these sources were considered comparable to those published in the literature for the nation as a whole. The current methods of protecting the public from radiation hazards were also examined and recommendations made with regard to the enforcement of existing codes. (auth)

9800 (NP-20020) ASPECTS OF RADIATION DOSIMETRY AND RADIOLOGICAL PROTECTION IN CANCER HOSPITALS OF THE NORTHEAST BRAZIL. Melo, H. C.; Roesler, I. C. (Universidade Federal de Pernambuco, Recife (Brazil). Centro de Energia Nuclear). 7 Jun 1972. 24p. Dep. NTIS (US Sales Only) $4.25.

Radiation protection programs in hospitals in Northeast Brazil where x or γ radiation is used for cancer therapy are reviewed. Methods used for monitoring radiation doses received by personnel are discussed. (CH)

9801 RECENT ADVANCES OF THE ASSESSMENT OF GENETIC HAZARDS OF IONIZING RADIATION. Sankaranarayanan, K. At. Energ. Rev.; 12: No. 1, 47-74(1974).

Estimates of genetic hazards to man from exposure to ionizing radiation are still to a large extent based on the results of studies with experimental mammals, notably the mouse. The review is devoted to an examination of the recent advances in the field of mammalian radiation genetics in the context of their relevance to the problem of hazard evaluations. Quantitative estimates are given using two methods of approach, pointing out the assumptions on which they are based and the uncertainties that are involved. In addition, the anticipated genetic hazards from the projected expansion of the nuclear power industry are dealt with. It is concluded that, for the radiation conditions applicable to humans (low dose, low dose-rate irradiation), the genetic risks appear to be much less than were estimated in the mid-fifties when radiation protection policies from the genetic standpoint were formulated, on the basis of results obtained at high doses and dose-rates. (auth)

9802 RADIATION DOSES IN PEDIATRIC NUCLEAR MEDICINE AND DIAGNOSTIC X-RAY PROCEDURES. Webster, E. A.; Alpert, N. M.; Brownell, G. L. (Massachusetts General Hospital, Boston). pp 34-58 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Critical organ doses in many radionuclide studies exceed the maximum skin doses delivered in plain radiographic examinations but are generally less than the skin doses delivered in angiographic and fluoroscopic examinations. Nearly all radionuclide imaging and function tests can be performed in children with doses of less than 3 rads to the critical organ. Several older but still common diagnostic radionuclide procedures deliver undesirably high absorbed doses to the internal organs of patients. These include kidney

imaging and brain imaging with ^{203}Hg-chlormerodrin, blood pool imaging studies using ^{131}I-HSA, and thyroid imaging and thyroid uptake using ^{131}I- and ^{125}I-iodide. Absorbed doses in these cases are higher in children than in adults; in infants they may be two to three times higher. The use of these radiopharmaceuticals in these procedures is discouraged, particularly since alternative radiopharmaceuticals are available employing shorter-lived radionuclides which deliver much lower doses. The use of ^{131}I-tagged radiopharmaceuticals for purposes other than thyroid studies may also result in undesirably high thyroid doses, even when the thyroid is blocked with saturated KI or LuGol's solution. Average whole-body doses in radionuclide procedures are usually considerably greater than whole-body doses from plain radiographic examinations and are similar in magnitude to those delivered in angiographic procedures. Placentography employing radioisotopes, on the other hand, delivers fetal doses lower by a factor of 100 than those delivered in conventional obstetric x-ray procedures. The calculation of absorbed dose in many radionuclide procedures is hampered by inadequate human metabolic data. Much of the data presently utilized is taken from animal experiments. Dosimetry at present is probably correct within a factor of 2. Further dose reduction in radionuclide procedures is desirable. The most promising avenue is the further development of radiopharmaceuticals tagged with short-lived isomers. (auth)

9803 FLUORESCENT IMAGING IN PEDIATRICS. Hendrix, R. W.; Hoffer, P. B. (Univ. of Chicago). pp 78-84 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The concept of x-ray fluorescence was adapted for thyroid scanning. An excitation source such as a sealed isotope source of ^{241}Am is used to stimulate characteristic x rays production in iodine within the thyroid gland. A special radiation detector made of lithium-drifted silicon is used to detect the characteristic x rays that are produced and to select them from the Compton scatter radiation that is also produced by the exciting beam interacting with neck tissue. The collimated source and detector are directed over the patient's neck in a manner similar to a conventional rectilinear scan, using the characteristic x rays to produce the gland image on a photographic film exposed to a light source. A total scan time of approximately 20 minutes is required to produce a satisfactory thyroid image. The use of the fluorescent thyroid scanning technique for pediatric and adult patients is discussed. Findings in the pediatric age group are similar to those in adults. Numerous advantages favor the fluorescent technique over radionuclide scanning in pediatric patients. The patient receives no total-body or gonadal radiation, and the thyroid receives approximately 15 millirads, as compared with multirad doses for a radionuclide scan. Specific information about iodine content of the gland is available only with the fluorescent technique. This information makes it possible to distinguish primary from secondary hypothyroidism. The image quality of the fluorescent scan appears to be about the same as that of the nuclide scan whenever both are available. (CH)

9804 HEALTH OF ATOMIC BOMB SURVIVORS: A DECADE OF EXAMINATION IN A FIXED POPULATION. Belsky, J. L.; Tachikawa, K.; Jablon, S. (Atomic Bomb Casualty Commission, Hiroshima and Nagasaki). Yale J. Biol. Med.; 46: No. 4, 284-296 (Oct 1973).

Since 1958 a population of about 16,000 exposed and sex- and age-matched nonexposed persons have been examined biennially at the Atomic Bomb Casualty Commission in Hiroshima and Nagasaki, Japan, to judge late effects of A-bomb radiation. The biennial checkups, in contrast to more probing studies with which they are compared, have shown few radiation-related effects. Screening examinations have revealed changes over time (1958 to 1968) in disease patterns and certain intercity aspects. In this survey, those who experienced the A-bomb disaster and survived seem generally to be as healthy as nonirradiated persons, though risks for specific late effects cannot be dismissed, particularly among those who were children at that time. (auth)

9805 MINIMIZING OCCUPATIONAL RADIATION EXPOSURE. Patterson, H. W.; Rich, B. Power Eng.; 78: No. 5, 52-53(May 1974).

Regulatory Guide 8.8, titled, "Information Relevant to Maintaining Occupational Radiation Exposure as Low as Practicable (Nuclear Reactor)," sets some very high standards for utilities in their health physics staffing. Plant health physics programs require high levels of technical skill in such areas as shielding calculations, dosimetry, detection, instrumentation, planning and operation, disaster planning, and environmental evaluations. Guide 8.8 suggests that the health physics chief possess certification equivalent to that issued by the American Board of Health Physics. Such certification implies a level of training and competence acceptable to the AEC as called for in its Regulatory Guide 8.8. (ERB)

9806 THIRD INTERNATIONAL CONGRESS OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION. Platthaus, D. Tech. Ueberwach.; 15: No. 3, 74-77(Mar 1974). (In German).

A brief review is given on the following main topics of the congress: 1) The effect of low dose rate on the population. 2) The laying down of upper dose limits for the radiation dose from nuclear power plants by the USAEC. 3) Radiation doses from x-ray diagnosis. 4) The position of the health physicists to the press and the public. (GE)

9807 RADIATION PROTECTION: A WAY OF LIFE. Morrow, B. Hydro News; 60: No. 3, 6-10(1973).

The highest occupation dose received by a worker employed in an Ontario hydro nuclear station was determined to be 37.6 rems in 10.5 years, or about 3.5 rems per year. The average for all atomic energy workers is much lower. Even the combined risk of exposure at occupational dose levels plus several diagnostic x ray studies annually is very low. Radiation monitoring methods used by industry and radiation protection standards for occupational exposure are reviewed. (CH)

9808 CHEMICAL RADIOPROTECTION OF RADIOLOGISTS. Goh, K. (Univ. of Rochester, NY). Lancet; 1: No. 7857, 568-569 (30 Mar 1974).

Brief note is made of results supporting those of a previous author (Goyanes-Villaescusa, V., Lancet, II, 575 (1973)). On the assumption that one of the mechanisms of chromosomal breakages in irradiated persons was due to a defect in DNA synthesis, cultures were supplied with deoxyribonucleoside triphosphates at G_2 and at S phases of cells known to have a high pulverization frequency. The results suggested that the phosphates were capable of restoring pulverized chromosomes. (UK)

9809 OPTIMIZATION OF IRRADIATION PLANNING IN DEEP ^{60}Co-THERAPY. Reproducibility of the Focusing, Demonstrated by the Example of an Irradiation Method in Renal Tumors. Bongartz, W.; Popp, F. A. (Marburg Univ., Ger.). Strahlentherapie; 146: No. 5, 576-581(Nov 1973). (In German).

At first a recently suggested method for the radiotherapy of renal tumors under telecobalt conditions is discussed, next the reproducibility of focusing is tested in comparison to a hypothetic bi-areal method. The relations, dealing with the judgement of the reproducibility, which were derived by the authors, are discussed. It was concluded that the method suggested for the radiotherapy of renal tumors under telecobalt conditions can be carried out clinically without significant risk. (auth)

9810 IRRADIATION METHOD AND DOSIMETRY IN CERVIX CANCER. Gell, G.; Kahr, E. (Graz Univ., Austria). Strahlentherapie; 146: No. 5, 511-522(Nov 1973). (In German).

The Graz-method of fractionated radium-telecobalt-therapy of the cervix cancer is reported. Dosimetry and isodose plan are performed by a computer belonging to the clinic. Irradiation planning, calculatory configuration, programming, as well as the course of the program and the functional course are described in detail. (auth)

9811 PROCEEDINGS OF THE SEVENTH NATIONAL CANCER CONFERENCE, LOS ANGELES, CALIFORNIA, SEPTEMBER 27-29, 1972. Philadelphia; J. B. Lippincott Company (1973). 983p. (CONF-720937-). $17.00.

Separate abstracts were prepared for four of the papers presented in these proceedings. The other papers are arranged in the following catagories: genetics and the cancer cell; immunology-human cancer; chemotherapy; head and neck cancer; female pelvic cancer; breast cancer; leukemia; lymphomas; viral and chemical carcinogenesis; surgery; radiotherapy; gastrointestinal cancer; tumors of the endocrine glands; skin cancer; childhood cancer; epidemiology; new frontiers in cancer; genitourinary cancer; cancer of the CNS; rehabilitation of the cancer patient; and bone and soft tissue sarcomas. (ERB)

For abstracts of individual papers see: 9812-9814 and 10150.

9812 RADIOBIOLOGICAL BASIS FOR THE USE OF IONIZING RADIATION. Suit, H. D. (Massachusetts General Hospital, Boston). pp 449-453 of Proceedings of the Seventh National Cancer Conference. Philadelphia; J. B. Lippincott Co. (1973).

From 7th national cancer conference; Los Angeles, California, USA (27 Sep 1972). See CONF-720937-.

The essential bases for the use of ionizing radiation in the treatment of human tumors are: (1) radiation kills mammalian cells, and (2) there is a favorable differential effect of radiation on tumor and normal tissues in many instances. The following points are briefly mentioned in the discussion of the radiobiological basis of radiotherapy: importance of tumor volume; significance of histopathologic type of tumor; basis of an advantage of radiotherapy over surgery; independence of response of normal tissue and tumor tissue; tumor destruction; and role of immunological re-

jection response against tumor in tumor destruction by x irradiation. (ERB)

9813 NEW HYPOTHESES ON THE ETIOLOGY OF CANCER. Miller, R. W. (National Cancer Inst., Bethesda, MD). pp 653-656 of Proceedings of the Seventh National Cancer Conference. Philadelphia; J. B. Lippincott Co. (1973).

From 7th national cancer conference; Los Angeles, California, USA (27 Sep 1972). See CONF-720937-.

New hypotheses on the etiology of cancer are discussed as they relate to the following epidemiological factors: chemicals; radiation; viruses; endogenous estrogens; genetics; familial cancer; congenital malformations; and alert practitioner program. (ERB)

9814 REASSESSMENT OF NEUTRON CAPTURE THERAPY IN THE TREATMENT OF CEREBRAL GLIOMAS. Brownell, G. L. (Massachusetts Inst. of Tech., Cambridge); Murray, B. W.; Sweet, W. H.; Wellum, G. R.; Soloway, A. H. pp 827-837 of Proceedings of the Seventh National Cancer Conference. Philadelphia; J. B. Lippincott Co. (1973).

From 7th national cancer conference; Los Angeles, California, USA (27 Sep 1972). See CONF-720937-.

Recent developments in boron compounds, flux distribution and dosimetry have led to renewed interest in clinical trials of neutron capture therapy. Preliminary biological studies in animals have been encouraging. Clinical trials currently being conducted in Japan show considerable promise. A program is currently under way leading to renewed clinical trials of neutron capture therapy for the treatment of brain tumors at MGH-MIT. (auth)

9815 UNIFYING CONCEPTS OF LEUKEMIA. Proceedings of the Vth International Symposium, Padua, Italy, 1971. Dutcher, R. M.; Chieco-Bianchi, L. (eds.). Bibliotheca Haematologica, No. 39. Basel; S. Karger AG (1973). 1292p. $82.25.

Separate abstracts were prepared for six of the 133 papers included. (CH)

For abstracts of individual papers see: 9816, 9894–9897, and 9982.

9816 RATIONALE AND RESULTS OF COMBINATION CHEMOTHERAPY AND CENTRAL NERVOUS SYSTEM IRRADIATION IN ACUTE LYMPHOCYTIC LEUKEMIA. Simone, J.; Pinkel, D. (St. Jude Children's Research Hospital, Memphis). Bibl. Haematol.; No. 39, 1068-1073(1973).

From fifth international conference on comparative leukemia research; Padua, Italy (1971).

The use of multiple agent combination chemotherapy for childhood acute lymphocytic leukemia has resulted in a 17% 5-year leukemia-free remission rate. The addition of more intensive CNS therapy early in remission in 1967 has resulted in a 61% 3-year leukemia-free remission rate and if the pattern of remission is similar to the earlier studies, a 50% 5-year leukemia-free remission rate can be expected. In a controlled study, one week of intensive intravenous chemotherapy early in remission was of no apparent benefit in children receiving multiple agent chemotherapy. In patients who received 2,400 R of craniospinal irradiation early in remission, the frequency of CNS relapse was 4.4% compared to 59% in patients who had not received that therapy. (auth)

9817 OSTEORADIONECROSIS OF THE JAW. Guttenberg, S. A. (Washington Hospital Center, Washington, DC). Amer. J. Surg.; 127: 326-332(Mar 1974).

A review of the literature indicates that, although the incidence of osteoradionecrosis appears to be declining, this disease process still occurs with some frequency. However, when certain preventive measures are taken in regard to the patient's oral and dental health, the incidence of severe postirradiation morbidity has been shown to be eliminated almost entirely. Because of the nature of the treatment modality, there will always be adverse changes in normal tissues when cancericidal doses are applied to tumors. However, it is prudent medical practice to minimize the incidence and extent of morbidity associated with radiation therapy of oral carcinoma, and this appears to be best accomplished by a team approach to the problem. Of necessity, this team must consist of dentists and physicians well versed in oncology and its radiotherapeutic management. (auth)

9818 GLOMUS JUGULARE TUMORS. II. A Clinicopathologic Analysis of the Effects of Radiotherapy. Spector, G. J.; Maisel, R. H.; Ogura, J. H. (Washington Univ., St. Louis). Ann. Otol., Rhinol., Laryngol.; 83: 26-32(1974).

Radiotherapy is an often used treatment in glomus tumors of the middle ear. Histologic evidence revealing nonuniform radiotherapeutic effect on tumor vessels is shown. The reticular tumor stroma is replaced by collagen. The chief cells demonstrate little change. The results in 19 radiated patients demonstrate that radiation eliminated the tumor in 20% of the cases. Radiation followed by surgery was more successful in tumor eradication than surgery followed by radiation. (auth)

9819 EFFECT OF THE RADIOTHERAPY ON URINARY AND SERUM BETA-GLUCURONIDASE ACTIVITY IN THE BLADDER CARCINOMA. Takenaka, I.; Ikeda, Y. (Tottori Univ., Yonago, Japan). Hinyokika Kiyo; 20: No. 1, 23-31(Jan 1973). (In Japanese).

Urinary and serum β-glucuronidase was determined by Tsukamoto's method as a biochemical index of therapeutic effect of radiation therapy of bladder tumor. The patients were divided into four groups, bladder tumor (Group 1), tumor of the kidney and renal pelvis (Group 2), prostatic carcinoma (Group 3), and urolithiasis and inflammation (Group 4). Over 70% of patients with bladder tumor showed β-glucuronidase higher than 1000 U. Group 2 and 3 also showed high β-glucuronidase level but in Group 4 the level was within normal range. Urinary β-glucuronidase remarkably elevated along the course of irradiation, transiently decreased at 2000 rads, again increased at 3,000 to 4,000 rads, and finally decreased at 6,000 rads. Administration of Glucaron, an inhibitor of β-glucuronidase, resulted in decrease of the enzyme level in all the recurrent tumor cases. The level, however, again increased along with growth of tumor. In the cases whose radiation therapy was completed, β-glucuronidase started to elevate regardless of the course of the tumor itself. The results proved that urinary β-glucuronidase is released into circulation from the tumor itself undergoing cellular degeneration due to radiation therapy. Urinary β-glucuronidase is a good biochemical index to determine if sensitivity to radiation therapy exists or not. (auth)

9820 BACTERIAL FLORA OF THE IRRADIATED SKIN IN PATIENTS UNDERGOING RADIOTHERAPY FOR MALIGNANT NEOPLASMS. Ciercialowa, M. (Academy of Medicine, Krakow). Pol. Tyg. Lek.; 27: 733-736(1972). (In Polish).

In 60 patients undergoing radiotherapy for malignant neoplasms of various organs bacteriological examinations were carried out to determine the bacterial flora of the skin from the irradiated fields. The state of bacterial flora was evaluated with respect to the kind and amount of bacterial colonies growing under aerobic conditions. It was demonstrated that the condition of bacterial flora of irradiated skin fields depends on the degree of reaction to radiation. Particularly in cases with strong oozing reactions the own method used by the author for obtaining live bacteria from the skin demonstrates that dynamics of development of staphylococci resistant to antibiotics that may be used in treatment of radiation-induced skin changes. (auth)

9821 AGING IN HIROSHIMA AND NAGASAKI ATOMIC BOMB SURVIVORS: SOLUBLE–INSOLUBLE COLLAGEN RATIO. Anderson, R. E.; Yamamoto, T.; Thorslund, T. (Atomic Bomb Casualty Commission, Hiroshima and Nagasaki). J. Gerontol.; 29: No. 2, 153-156(Mar 1974).

The soluble–insoluble collagen ratio was determined in aortas removed at autopsy during the period 1966 to 1970 (21 to 25 years post exposure); 261 specimens were examined from persons of both sexes, age 30 to 89 years at death. A portion of the test samples were from persons located less than 1500 meters from the hypocenter at the time of the bomb; the majority of such individuals are thought to have absorbed a significant amount of ionizing radiation. Over-all, the ratio in this group was not significantly different from a comparable cadre of individuals who were not in the cities of Hiroshima and Nagasaki at the time of the explosions. However, a possible discrepancy was noted between the two exposure groups involving both males and females who were less than 60 years of age at the time of death with lower average values among the exposed groups. An interpretation of the latter observation is discussed and related to the experimental situation where the life-shortening effects of radiation are most pronounced when the animals are exposed at a young age. (auth)

9822 LATE COMPLICATIONS OF RADIATION-INDUCED DAMAGE TO THE GASTRO-INTESTINAL TRACT. Wolloch, Y.; Chaimoff, C.; Dintsman, M. (Tel Aviv Univ., Israel). Amer. J. Proctol.; 24: 473-480(Dec 1973).

Nine patients were treated in our hospital during the past eight years for severe gastrointestinal tract complications appearing nine months to five years after radiation therapy. In three patients a colostomy was performed because of severe inflammation and narrowing of the rectosigmoid region. Another patient, with gangrene of the sigmoid, underwent resection of the damaged bowel and colostomy. She died several weeks later because of a pelvic abscess, the result of a perforation of the terminal ileum. At autopsy gangrene of the anterior rectal wall and of the lower segments of both ureters was also found. One patient, who was irradiated after nephrectomy for carcinoma of the left kidney and who was operated on two and a half years later because of a suspected tumor of the splenic flexure of the colon, was found to have a circular stricture induced by radiation. Four other patients are

still receiving regular enemata of hydrocortisone, sedatives, and a low residue diet over a period ranging from ten months to three years and ten months, because of persisting activity of the disease. Despite the large number of women who receive radiotherapy, only a small percentage suffer damage to the gastrointestinal tract. There is no single explanation for this. It would appear that an individual sensitivity to the effect of irradiation exists, and that radiation induced damage to the gastrointestinal tract will appear in these more sensitive patients. (auth)

9823 LOCAL CONTROL AND SITE OF FAILURE OF RADICALLY IRRADIATED SUPRAGLOTTIC LARYNGEAL CANCER. Ghossein, N. A.; Batani, J. P.; Ennuyer, A.; Stacey, P.; Krishnaswamy, V. (Albert Einstein College of Medicine, Bronx, NY). Radiology; 112: No. 1, 187-191(Jul 1974).

The local control and complications after radical γ radiation therapy were analyzed in 203 patients with supraglottic carcinomas, using time-dose scattergrams and nominal standard dose (NSD). A dose-response curve was obtained for early tumors but was not demonstrated in advanced neoplasms. All nodes less than 2.5 cm in diameter were controlled with 7,000 rads. Of the early lesions 89% were controlled with 7,700 rads in six weeks. Over 85% of the involved nodes were controlled when the primary was cured. The incidence of major complications did not exceed 7%. (auth)

9824 SMALL-FIELD IRRADIATION IN CARCINOMA OF THE CERVIX, USING A LINEAR ACCELERATOR AND A NEW BEAM-DIRECTING DEVICE. Sakaguchi, M.; Fujiwara, T.; Tanaka, Y. (Tenri Hospital, Japan). Radiology; 112: No. 1, 193-196(Jul 1974).

A new beam-directing device for use during radiotherapy using supervoltage x radiation consisting of a rod with a central pivot is described. One end is fixed to a device placed in the cervical canal to immobilize the uterus, while the other end is connected to a series of potentiometers used to detect any movement of the uterus. A total of 92 cases of carcinoma of the cervix were treated by means of a whole-pelvis irradiation with 6,000 rads to a large field using a linear accelerator and the device described above, followed by 3,000 to 4,500 rads to a small field using a lateral pendulum. (auth)

9825 PROTECTION FROM CHEMOTHERAPEUTIC EPILATION BY PRIOR IRRADIATION. Cassady, J. R.; Jaffe, N. (Children's Hospital Medical Center, Boston). Radiology; 112: No. 1, 197-198(Jul 1974).

Three patients showed striking preservation from chemotherapy-induced epilation in previously irradiated areas. Possible mechanisms for this protection are discussed. (auth)

9826 SPONTANEOUS PNEUMOTHORAX AS A COMPLICATION OF RADIATION THERAPY TO THE THORAX. Libshitz, H. I.; Banner, M. P. (Thomas Jefferson University Hospital, Philadelphia). Radiology; 112: No. 1, 199-201(Jul 1974).

Two cases of spontaneous pneumothorax in patients who received extended field radiation therapy to the thorax for Hodgkin's disease are presented. Radiation changes in the lung developed in both patients. The mechanism of development of pneumothorax is felt to be similar to that seen in other interstitial fibrotic lung disease. (auth)

9827 CORRELATION OF PHYSICAL CHARACTERISTICS OF 4 MV X-RAY BEAMS WITH SKIN REACTIONS OF PATIENTS UNDERGOING RADIATION THERAPY. Jacobson, A.; Birkhead, B. M.; Scott, R. M. (Univ. of Louisville Radiation Center, KY). Radiology; 112: No. 1, 203-207(Jul 1974).

Skin reactions found in some patients undergoing radiotherapy with a Clinac-4 linear accelerator 4 MV x-ray beam are reviewed. Various physical parameters of this machine were measured in an effort to explain these reactions. Qualitative and quantitative results indicate an undesirable edge effect from the lead-antimony beam flattening filter, manifested by a halo region found at the periphery of large treatment fields. Higher radiation intensity and modified beam quality were demonstrated in this peripheral halo region. Clinical treatment factors and patient skin reactions are discussed in relation to these physical measurements. (auth)

9828 RADIATION THERAPY OF THE NON-HODGKIN'S LYMPHOMAS. Peckham, M. J. (Inst. of Cancer Research, London). Seminars Hematol.; 11: No. 1, 41-58(Jan 1974).

The subject is discussed in some detail under the following headings: response of localized presentations of non-Hodgkin's lymphomas to radiotherapy; extranodal presentations; head and neck lymphomas; gastrointestinal malignant lymphomas; the non-Hodgkin's lymphoma in childhood; dose-time relationships in the malignant lymphomas; the elective irradiation of apparently uninvolved nodal areas in the non-Hodgkin's lymphomas; staging in the non-Hodgkin's lymphomas; and whole-body irradiation for generalized lymphocytic lymphoma. (ERB)

9829 INFLUENCE OF ATMOSPHERIC OZONE VARIATIONS ON SOME OF THE BIOLOGICAL ACTIVITIES OF SOLAR ULTRAVIOLET RADIATION. Chavaudra, J. (Univ., Paris); Latarjet, R. pp 1.3.1-1.3.7 of Franco–British Seminar on the Consequences of Stratospheric Flights. Paris; COVOS (1973). (In French)

From Franco–British seminar on the consequences of stratospheric flights; Paris, France (22 Mar 1973).

Determination of the relation between reduced ozone layer thickness and two important biological activities of solar ultraviolet radiation, namely: the abiotic and mutagenic effect upon prokaryocytes and the erythemogenic and carcinogenic effect on the skin of white man. This relation makes it possible to predict the activity variations that are to result from induced changes in the quantity of atmospheric ozone. In view of prevailing trends toward the development of supersonic flight in the stratosphere, this problem is not without a certain urgency. (IAA)

9830 CHEST RADIOGRAPHY AT 200 kV. Thomas, R. G.; Wiles, F. J.; Sluis-Cremer, C. K. (Miners' Medical Bureau, Johannesburg). S. Afr. Med. J.; 47: 2645-2648(29 Dec 1973).

Ultra-high kilovoltage chest radiography was first tried in the 1950s. Experience is described using sophisticated modern diagnostic apparatus designed for use at 200 kV. The advantages are that radiographic bone density is reduced with enhanced demonstration of the thoracic viscera, very small exposures are required and the exposure latitude is large. Poor demonstration of fat and small calcifications are possible disadvantages. A moving grid was found more effective than an airgap for reducing radiation scatter. Processing problems encountered with films exposed at 200 kV were greater with some makes than others. Chest radiography at 200 kV has proved a successful and useful addition to the diagnostic armamentarium of the Miners' Medical Bureau, Johannesburg. (auth)

9831 OSTEORADIONECROSIS OF JAW BONES. Andra, A.; Beetke, E. (Universitaetsklinik und Poliklinik fuer Stomatoloie, Rostock, Ger.). Deut. Stomatol.; 23: 713-721(Oct 1973). (In German).

The clinical part of this paper deals with 21 osteoradionecroses (8.3%) of the jaws which had been observed in 252 patients subjected to irradiation therapy (alone or in combination with surgical measures) for malignant tumors in the maxillofacial region. Osteoradionecrosis had developed within 30.9 months (on an average). Treatment-free periods and the use of another kind of radiation will not always exclude osteoradionecrosis. The most unfavorable effects resulted from radium application (moulage) and conventional x-ray therapy, whereas no osteoradionecrosis has been stated up to now (after three years of observation), subsequent to telecobalt therapy. (auth)

9832 ELIMINATIONS OF 17 HYDROXICORTICOSTEROIDS AND TOTAL NEUTRAL 17 KETOSTEROIDS IN SUBJECTS LONG-TERM OCCUPATIONALLY EXPOSED TO IONIZING RADIATIONS. Lancranjan, I.; Popescu, H. I. (Academia de Stiinte Medicale, Bucharest). Health Phys.; 26: No. 6, 575-577(Jun 1974).

During the periodical check-up of subjects occupationally exposed to ionizing radiations, the 24 h urinary eliminations of hydroxicorticosteroids (17 OH) and total neutral 17 ketosteroids (17 KS) were followed up in 80 subjects long-term exposed in industry, in medical radiology, and in uranium mines, in order to assess the adrenal function. The investigation was due to the observation of a high incidence of asthenic syndrome and of hypotension in subjects occupationally exposed to radiations, symptoms suggesting the existence of mild adrenal insufficiency. The mean values of 17 OH eliminations in subjects exposed were significantly lower ($P < 0.001$) as compared with those of 25 controls. The 17 KS elimination was not significantly decreased. The results are in agreement with the experimental data known, which proved histologic changes, enzymatic troubles, and impaired adrenal function after acute irradiation. The ACTH Gel test, carried out in 10 subjects showing decreased values, was normal suggesting that the adrenal insufficiency is due to an insufficient ACTH secretion. (auth)

9833 INDUSTRIAL MILLIREMS AND MEDICAL REMS. Pretre, S. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen, Switzerland). Health Phys.; 26: No. 6, 580(Jun 1974).

Dr. Prêtre answers Professor Oliver's letter (Health Phys.; 26:279 (1974) which commented on Dr. Prêtre's earlier letter (Health Phys.; 25:201 (1973)) concerning the hazards of diagnostic radiology. The question raised in the original letter of the difference between the "genetically significant dose" and the "cancer significant dose" is discussed. (UK)

9834 HAZARDS OF DIAGNOSTIC RADIOLOGY. Oliver, R. (Hammersmith Hospital, London). Health Phys.; 26: No. 6, 579-580(Jun 1974).

Comments are made on Dr Prêtre's letter (Health Phys.; 25:201(1973)) concerning the hazards to the public of diagnostic radiology. Minimal radiation exposure from all sources is a reasonable aim, but a member of the public will always be more willing to accept a small, but delayed risk from radiography in return for immediate medical help, than an even lower nominal risk associated with an environmental radiation source. However, he agrees there is a need for good practice and techniques in all hospitals to reduce the dose received by the public to the absolute minimum that is practicable. (UK)

9835 ENZYMATIC SPECTRUM OF BLOOD SERUM IN PATIENTS WITH BREAST CANCER DURING THE COMPLEX CHEMO-RADIATION THERAPY. Lugovoy, V. I.; Kutsyi, A. S.; Kravchenko, L. P. (Inst. of Cryogenic Biology and Medicine Problems, Kharkov). Vop. Onkol.; 20: No. 4, 20-22(1974). (In Russian).

The activity of hexokinase, phosphohexoisomerase, phosphoglucomutase, lactic dehydrogenase, and acid ribonuclease was studied in blood serum of patients with breast cancer during chemo-radiation therapy under a protection of transfusions of autologous and donor bone marrow, frozen at low temperature (−196°C). No hexokinase activity was found during chemo-radiation therapy, whereas the activity of lactic dehydrogenase was normalized in the posttransfusion period. No significant changes were noted in the activity of other enzymes under study. (auth)

9836 ATYPICAL FIBROXANTHOMA OF THE SKIN. Poroshin, K. K.; Galil-Ogly, G. A.; Blinov, V. M. (Moscow Scientific-Research Inst. of Roentgen-Radiology). Arkh. Patol.; 36: No. 3, 31-36(1974). (In Russian).

Clinico-morphological characteristics of atypical fibroxanthoma removed in 9 patients is described. The neoplasm appeared on the changed skin (irradiation, trauma) in elderly people and localized on the face. Prognosis was favorable. No recurrences were noted. The neoplasm consisted of distorted cells with abnormal polymorphic nuclei, cells with foamy cytoplasma (xanthomic) and fibroblasto-like cellular elements. In microscopic investigation it should be differentiated from sarcoma, melanoma, anaplasial cancer. The authors support the opinion of those investigators who consider atypical fibroxanthoma as a pseudotumor reactive process. (auth)

9837 LYMPHOCYTE RESPONSE AFTER RADIOTHERAPY. Wood, S. E. (Glasgow Royal Infirmary); Campbell, J. B.; Anderson, J. M.; Kelly, F. Lancet; 1: No. 7862, 863(4 May 1974).

A study was made of the effect of postoperative radiotherapy for mammary cancer on lymphocyte rosette formation with sheep red blood cells. The modal dose of radiotherapy to the wound flaps was 4300 rads (300kV), and an incident dose of 4500 rads (4MV) was given to the supraclavicular and axillary regions, both doses in 20 exposures during 4 weeks. Mastectomy alone produced no significant changes during the 81 weeks observed after operation. Mastectomy and radiotherapy produced immediate and prolonged suppression of the absolute numbers of T and B subpopulations, the B levels returning to normal after 48 weeks, the T lymphocytes being depressed for more than 81 weeks. (UK)

9838 PHYSICAL ASPECTS OF RADIOTHERAPY TREATMENT TECHNIQUES. Karzmark, C. J. (Stanford Univ., CA). pp 61-62 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

The physical aspects of several treatment techniques are described in terms of procedure and equipment. Included are isocentric methods of treatment and large-field radiotherapy methods required in the treatment of malignant lymphomas such as Hodgkin's disease. Dosimetry and field-shaping problems are mentioned. (ERB)

9839 DETECTION AND EVALUATION OF LOCALIZATION ERRORS IN PATIENT RADIATION THERAPY. Haus, A. G.; Marks, J. E. (Univ. of Chicago). Invest. Radiol.; 8: No. 6, 384-391(1973).

In the radiotherapeutic treatment of patients, inability to irradiate the entire diseased area consistently and accurately can result in local failure or improper control of disease. Since 1969, a film technique developed for imaging of the complete patient radiation exposure was applied to evaluate localization errors occurring in radiotherapy. The technique basically involves placing a film with good image quality, proper sensitivity, and contrast in the exit-dose exposure ranges encountered in radiotherapy, under the patient during the entire radiation exposure. In the evaluation of the film a localization error was noted when portions of the diseased area were not properly included in the treatment field, or when an excessive region of normal tissue was improperly shielded. Examples from an investigation are shown whereby verification films were taken for every treatment in 5 selected cases, including 3 patients treated with extended mantle fields and 2 treated with pelvic fields. In this study, 62 out of 206 treatments showed localization errors. For the extended mantle fields in this study, if a localization error occurred, it was usually propagated throughout the treatment. The main goal in reducing errors in radiation therapy is to provide optimum treatment for the patient. In the past, much work has been done to reduce errors in dosimetry. It is clear from the results described that a major effort must also be made to minimize localization errors. (auth)

9840 EPIDEMIOLOGY OF LONG-TERM SURVIVAL WITH ACUTE LEUKEMIA. Gibson, R. W.; Graham, S. (State Univ. of New York, Buffalo). New Engl. J. Med.; 290: No. 11, 583-587 (14 Mar 1974).

To define factors distinguishing long-term from short-term survivors among children with acute leukemia, 59 who survived for at least five years were compared with 59 who survived for two years or less. The two groups were matched for age, sex, histology and time and physician of treatment. Seven traits characterized the patient with the highest likelihood of short-term survival. Short-term survivors differed from the long-term in having had a high initial white-cell count; their mothers were less likely to have had complications during their pregnancies with the subjects, were more likely to have had a history of disease, viral and other, in the five-year period before the subject's birth, were more likely to have had irradiation when pregnant with the subject, and were more apt to have been older at their first live birth; the subject was more likely to have been a product of a third or later pregnancy. Thus, of the characteristics examined, those relating to the mother's pregnancy and disease history appeared most cogent. (auth)

9841 LYMPHOCYTE RESPONSE TO PHYTOHAEMAGGLUTININ AFTER IN VITRO IRRADIATION. Braeman, J.; Moore, J. L. (Velindre Hospital, Whitechurch, Cardiff, Eng.). Brit. J. Radiol.; 47: No. 557, 297(May 1974).

Lymphocyte response to phytohemagglutinin was studied after in vitro radiation of 100 to 3600 rads from a ^{137}Cs source. Results showed a fall in lymphocyte transformation from 73.2% with no irradiation, to 3.5% with a dose of 3600 rads. The observations corresponded to a fall in transformation in patients receiving radiotherapy for bronchial carcinoma. In these patients the average pre-treatment response was 54.3%, and 12.8% at the end of treatment with an average dose of 3200 rads. In radiotherapy patients, the average proportional drop in PHA response was 74.2% compared with a drop in the in vitro cultures of 95.2%, where a greater proportion of cells were irradiated. It is suggested that these results confirm the suggestion that PHA response could be used as a monitor of radiation damage. (UK)

9842 HIGH-DOSE METRONIDAZOLE. A Preliminary Pharmacological Study Prior to its Investigational Use in Clinical Radiotherapy Trails. Urtasun, R. C.; Strumwind, J.; Rabin, H.; Band, P. R. (Univ. of Alberta, Edmonton). Brit. J. Radiol.; 47: No. 557, 297-299(May 1974).

Metronidazole (Flagyl), administered in the morning on an empty stomach at 2.5 g/m^2, resulted in blood concentrations of 500 to 800 μM within the first two hours. The only toxicity observed was transient moderate anorexia, nausea, and vomiting, which could be controlled with antiemetic medication administered half an hour before drug ingestion. These results, together with indications from other workers that a concentration of 400 to 500 μM (58 to 83 μg/ml) of metronidazole was required in the extra cellular medium at irradiation time to achieve an ER of 1.25 to 1.30 in hypoxic cells, and that higher doses than those predicted in vitro are necessary to obtain significant radiosensitization, were taken as a basis for initiating a study of two human tumor systems. Blood concentrations of metronidazole of 1000 to 1500 μM, combined with radiation in a 3 week fraction per week schedule over a period of four weeks will be used. (UK)

9843 RADIATION-INDUCED COMPLICATIONS OF GRADE III CERVICAL CARCINOMA DEPENDING ON THE METHOD OF IRRADIATION OF PARAMETRIA. Hliniakowa, I.; Wozniakowska, Z. (Klinika Ginekologii Onkologii, Gliwice, Poland). Pol. Przegl. Radiol. Med. Nukl.; 38: No. 1, 61-66(1974). (In Polish).

The frequency of complications induced by radiation was evaluated in relation to the method of irradiation of parametria. In recent years the methods of radium therapy and x-ray therapy at the Institute of Oncology in Gliwice have been changed or new methods have been introduced. Since 1958 the Manchester method of radiotherapy of cervical carcinoma, and since 1966 ^{60}Co radiotherapy to parametria have been introduced. (auth)

9844 MEASUREMENTS OF EXPOSURE DOSE OUTSIDE THE RADIATION FIELD UNDER CONDITIONS OF CONVENTIONAL RADIOTHERAPY AND TELECOBALTTHERAPY. Kobierska, A.;

Karnicka-Mlodkowska, H.; Ostrowska, T. (Kliniki Radioterapii, Danzig). Pol. Przegl. Radiol. Med. Nukl.; 38: No. 1, 67-70(1974). (In Polish).

Results of measurements of the exposure dose on the surface of the body of patients treated with gamma radiation from ^{60}Co and with x radiation under conditions of conventional treatment are presented. The cases treated received radiotherapy to the pelvis, mediastinum, and maxillary sinus. The measurable dose of exposure in cobalt radiotherapy reached 70 to 90 cm outside the field of radiation while in conventional treatment it reached 60 cm outside the field. The fall in the dose immediately outside the borders of the field was more evident in cobalt therapy than in x-ray therapy. In both types of therapy the exposure does to the gonads was small. (auth)

9845 USE OF DIGITAL COMPUTER FOR CALCULATION OF DISTRIBUTIONS OF DOSE INTENSITY AROUND THE SYSTEMS OF ^{192}Ir APPLICATORS. Bulski, W.; Majenka, I. (Zakladu Fizyki Instytutu Onkologii, Warsaw). Pol. Przegl. Radiol. Med. Nucl.; 38: No. 1, 71-76(1974). (In Polish).

A program was prepared for a digital computer permitting calculation of the distribution of the intensity of doses around the applicators of radioactive iridium ^{192}Ir used for interstitial therapy. The program written in the language Fortran IV and fed into a CDC 3170 digital computer makes it possible to perform calculations in any plane in the space for any number of rectilinear applicators. The absorption of radiation in soft tissues was taken into account. The results are presented in the form of isodose maps printed on a hand-press. (auth)

9846 RADIATION THERAPY WITH NEGATIVE PIONS. A Proposal for Clinical Trials. Wideroee, R. Radiat. Environ. Biophys.; 11: No. 1, 15-20(Mar 1974).

Using the 2-component model of radiation, a successful treatment scheme for electron therapy is analyzed and the number of surviving tumor cells is calculated. The conversion of anoxic to euoxic cells, which is not well known, is of decisive importance. This uncertainty can be much reduced when negative pions are used. A scheme where pions are supplementing an initial electron irradiation program is considered and calculated. The pion beam needs no cleaning from electron contamination but the magnitude of electron doses must be measured. (auth)

9847 RADIATION-INDUCED CANCER IN JAPANESE RADIOLOGICAL WORKERS. Kitabatake, T. (Niigata Univ., Japan); Watanabe, T.; Koga, S. Strahlentherapie; 146: No. 5, 599-606(Nov 1973).

There were 83 deaths caused by professional radiation injury recorded in Japan, the data of which are complete and available in 30 cases of skin cancer, 28 leukemias, 7 aplastic anemias, and 9 other diseases. The average latent period is 22.2 years in skin cancer, 17.7 years in leukemia, and 19.1 years in aplastic anemia. There is no definite relation between the radiation dose and the length of the latent period, except for skin cancer in which the latent period tended to be short, with an increase of the initial three years dose. The age of onset of skin cancer also tended to be younger with an increase of radiation dose. (auth)

9848 SKIN DOSE FROM HANDLING UNSHIELDED SYRINGES. Merrick, M. V. (Hammersmith Hospital, London). Brit. J. Radiol.; 47: No. 557, 300(May 1974).

Brief comment is made on a previous paper concerning potential high radiation doses to the fingers in contact with unshielded syringes (Henson, P. W., Br. J. Radiol., 46, 972-977(1973)). It is pointed out that there is no excuse for dispensing radionuclides in full or almost full syringes. (UK)

9849 RADIOLOGY NOW. The 10-Day Rule. Warrick, C. K. (Royal Victoria Infirmary, Newcastle upon Tyne, Eng.). Brit. J. Radiol.; 47: No. 557, 293(May 1974).

It is suggested that those who draft the next Code of Practice should add to the paragraph ending "should be carried out within 10 days following the first day of the menstrual period" the words "unless the patient is able to provide a written assurance that there is no possibility of pregnancy". An example is given of a form in use at the Royal Victoria Infirmary, Newcastle upon Tyne, designed to produce the necessary information before radiography of women of child-bearing age. (UK)

Vertebrates

Refer also to abstract 12115.

9850 (AEC-tr-7457, pp 4-10) CLINICAL MANIFESTATIONS OF INJURIES TO DOGS EXPOSED TO WHOLE-BODY NONUNIFORM RADIATION. Darenskaya, N. G.; Popov, A. V.; Avetisov, G. M.; Nelyubov, A. A.; Pravdina, G. M.; Khar'kov, Yu. I. 1972. Translated from pp 5-9 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Results are reported from studies on the quantitative relationship between radiation injuries and survival of dogs and degree of nonuniformity of absorbed dose distribution in the cases of multilateral, unilateral, craniocaudal, and caudocranial γ irradiation. The studies were conducted on 230 dogs. Distribution of deep doses was measured using a ferrous sulfate dosimeter and paraffin phantoms of dogs of the proper size. The doses absorbed by internal organs were estimated using organ models of polyvinyl chloride film filled with ferrous sulfate solution and placed appropriately in the animal's carcass. The exposure dose levels constituted 110 to 160 rads/min with all irradiation methods. Pathological changes and survival time are reported. These studies on dogs corroborate the findings obtained on rats and rabbits to the effect that it is impossible to use mean tissue dosage as a criterion to evaluate biological effects of nonuniform radiation. In the case of nonuniform radiation, the biological effect is determined not only by distribution of absorbed doses, but also by radiosensitivity of organs that receive the maximum dose load. (CH)

9851 (AEC-tr-7457, pp 11-17) WHOLE-BODY NONUNIFORM γ IRRADIATION OF RABBITS: TISSUE DOSE DISTRIBUTION. Avetisov, G. M.; Sokolova, I. K. 1972. Translated from pp 9-13 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Data are presented pertaining to a comparative study of uniform and four methods of nonuniform total-body γ irradiation of rabbits, with analysis of the quantitative characteristics of lesions on the basis of estimating the distribution of tissue doses in the animal's body. Pathological changes and survival time are reported. The results indicated that nonuniform irradiation is less damaging than uniform-irradiation; mean tissue and mean air doses are not parameters that unequivocally describe the biological effect of nonuniform irradiation; and the results of measurement of doses absorbed in different organs permit evaluation of the degree of involvement of different lesion syndromes in the ultimate effect and interpretation of the quantitative and clinical distinctions of development of radiation injuries following nonuniform exposure. (CH)

9852 (AEC-tr-7457, pp 18-24) DISTURBANCES IN THE ANIMALS FOLLOWING NONUNIFORM γ IRRADIATION. Beletskii, V. P.; Vedernikov, A. N.; Mudretsov, N. I.; Niskovskii, V. M.; Rezontov, V. A.; Tolchenkova, A. V. 1972. Translated from pp 13-17 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Results are reported of investigations to determine the correlation between damaging effects of nonuniform (lengthwise) γ irradiation of rats and dogs. Pathological changes and survival time are reported. From the standpoint of radiant energy expended per unit of biological effect, uniform irradiation was the most effective. Deviations from uniform distribution of dosage along the body require additional radiant energy to reach the same effect. The hypothesis that there is a direct link between viability of animals exposed to nonuniform radiation and share of intact, active hemopoietic tissue coincides satisfactorily with the experimental data. Pathology in the case of nonuniform irradiation was characterized by changes in the skin, mucosa of the mouth, esophagus, and respiratory tract (upon reaching the dose threshold of 1,500 to 1,600 rads delivered to the anterior part of the body), and depression of hemopoietic tissue at intermediate dose ranges. (CH)

9853 (AEC-tr-7457, pp 25-32) CIRCADIAN RHYTHM OF PHYSIOLOGICAL PROCESSES AND RADIOSENSITIVITY. Kuznetsova, S. S. 1972. Translated from pp 17-22 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The circadian rhythm of vital functions of living organisms is determined by the sum of changes occurring in inanimate nature as earth rotates around its axis (fluctuations in illumination, barometric pressure, air temperature and humidity, cosmic radiation, electric potential of the atmosphere, and gravitation). In the process of adapting to changing environmental conditions, living organisms developed a specific mechanism to control rhythmic processes. For this reason, the circadian rhythm is a general biological pattern that is manifested at all levels of development of living nature, ranging from protozoa to highly organized animals and man. Results are reported from studies on mice exposed to 580 R γ radiation for three hours a day morning or evening over a three-day period that indicate a definite effect of circadian rhythm on radiosensitivity as measured by survival time. (CH)

9854 (AEC-tr-7457, pp 33-42) RADIATION INJURIES OF MAMMALS FOLLOWING PROLONGED IRRADIATION. Koznova, L. B. 1972. Translated from pp 22-28 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Data are presented on the biological effects of acute and prolonged experimental γ irradiation of mice, rats, guinea pigs, rab-

bits, and dogs. A comparative analysis was made of dose functions for survival of different animals following exposure to a constant dose level and dose rate under identical experimental conditions. A species-specific radiosensitivity was observed. (CH)

9855 (AEC-tr-7457, pp 61-66) GAMMA CONTRIBUTION TO BIOLOGICAL EFFECTS OF MIXED GAMMA AND NEUTRON RADIATION. Shaporov, V. N. 1972. Translated from pp 39-43 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Rats were exposed to mixed γ-neutron or γ irradiation at doses of 200 to 500 rads and the survival time was determined. After processing the data by the least squares method, it was found that mixed γ-neutron radiation with 18% γ was the most damaging. The differences between dose functions with 18 and 31% γ contributions and between γ-neutron and γ radiations were statistically reliable. As the γ component of the total dose increased, a decline in animal death was noted at dose levels above and below $LD_{50/30}$. (CH)

9856 (AEC-tr-7457, pp 67-74) DISTURBANCES IN SYSTEMS OF MICE FOLLOWING IRRADIATION WITH FISSION SPECTRUM NEUTRONS. Pronin, L. S.; Mudretsov, N. I.; Oreshkin, I. G.; Malakhovskii, V. N.; Khoruzhenko, A. F.; Rezontov, V. A. 1972. Translated from pp 43-49 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Mice were exposed to γ radiation or a γ-neutron flux. Gamma radiation at doses of 100 to 900 R was delivered from a ^{60}Co source at the rate of 300 R/hour and a point source distance of 65 cm. Mixed γ and neutron irradiation was administered within less than 10^{-3} second. The neutron spectrum was close to the fission spectrum, and mean energy constituted 1.5 MeV. The γ and neutron flux was estimated in air as related to a biological point source (mice). The dosage constituted 250 to 360 rads. The γ component contribution in the direct flux constituted 10 to 20% of the total dose, and it increased at the site of the animals. The animals were examined at intervals ranging from 6 hours to 60 days. From the data on γ and γ-neutron irradiation of mice, the dose-time-effect relationship was determined for a number of clinicobiological and pathomorphological criteria. These included percentile mortality; changes in hemopoietic organ weight, changes in mitotic activity in intestinal crypt cells, and changes in the weight of testicles. The results obtained with γ irradiation indicate that all of the indices studied were subject to changes, and the severity thereof was in some relationship to dosage. The nature of the changes in these indices was typical for the medullary form of acute radiation sickness. An analogous form of acute radiation lesion developed in the mice with exposure to a mixed flux of γ and neutron radiation in doses of 250 to 360 rads. However, quantitatively and qualitatively, the damage to different organs and systems was not the same in severity. (CH)

9857 (AEC-tr-7457, pp 75-85) LONG-TERM POSTIRRADIATION BONE MARROW HEMOPOIESIS IN MICE. Strel'tsova, V. N.; Strashnenko, S. I. 1972. Translated from pp 50-58 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

An effort was made to investigate the state of the chromosomal system of bone marrow hemopoietic cells and medullary hemopoiesis starting on the first day after irradiation and up to the time of demonstration of postirradiation leukemia. Experiments were performed on 136 female mice exposed to x rays four times at one-month intervals, at a dose rate of 20.4 R/min, and single doses of 200 R and cumulative dose of 800 R. The mice were sacrificed by decapitation on the 1st, 5th, and 30th days after each exposure; then, at random, as the animals' condition deteriorated, the ones in poorest condition were sacrificed on the 60th, 90th, 120th, 150th, 180th, and 200th days following the last exposure. An average of 50% of the cells examined on the first day following irradiation showed chromosomal aberrations. Mice receiving total doses of 200 and 400 R did not develop leukemia, however, two out of five mice exposed to 600 R total doses developed leukemia within 30 days following the last irradiation. (CH)

9858 (AEC-tr-7457, pp 95-103) EFFECT OF EXTERNAL IRRADIATION ON UPTAKE AND RETENTION OF RADIOACTIVE ISOTOPES IN MAMMALS. Kalistratova, V. S. 1972. Translated from pp 64-70 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The literature dealing with metabolism of radioisotopes in irradiated mammals is reviewed in relation to dose, time of external exposure, and route of radionuclide administration. In spite of the fact that the protocols of the experiments reported were very diverse and it was difficult to compare the findings (different means of administration, species of animals, time of administration of the isotope after irradiation, dosage of external irradiation, etc.), a number of general behavior patterns in irradiated animals were demonstrated for most radioactive isotopes that are representative of different groups of elements in Mendeleyev's periodic table. An increased isotope level was observed at the early stages after irradiation, with all means of administration except by mouth, and there was a particularly noticeable increase in accumulation in critical organs. When isotopes were administered by mouth to the irradiated organism, the condition of the GI tract played a significant part. As a result of gastric atonia and impaired resorption processes in the stomach and intestine during the first day, a 2 to 3-fold drop in isotope content of organs was observed, as compared to the control. Thereafter the isotope level increased in tissues and organs of irradiated organism, as with other means of administration of the isotope, due to inhibited renal function and decreased volume of urine and feces. (CH)

9859 (AEC-tr-7457, pp 116-122) DISTRIBUTION OF ^{131}I IN RATS FOLLOWING SEPARATE AND COMBINED EXPOSURE TO THIS ISOTOPE AND ^{60}Co γ RAYS. Moskalev, Yu. I.; Egorova, G. M. 1972. Translated from pp 77-82 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Whole-body irradiation of rats with ^{60}Co γ rays at a dosage of 300 R altered ^{131}I uptake in organs and tissues, increasing its levels for the first minutes and hours and retarded excretion of the isotope in urine and feces. No differences were demonstrated in distribution of the isotope in organs and tissues of preirradiated animals (3 days prior to the isotope) and in animals exposed to subsequent (8 days after the isotope) radiation. Whole-body irradiation of rats with extirpated thyroid, using ^{60}Co γ-rays in a dosage of 300 R, increased iodine uptake in organs and tissues and retarded its excretion. (auth)

9860 (AEC-tr-7457, pp 127-134) DEVELOPMENT AND COURSE OF PATHOLOGICAL PROCESSES RELATED TO EXPOSURE OF MAMMALS TO RADIATIONS FROM EXTERNAL AND INTERNAL SOURCES. Besyadovskii, R. A.; Dmitriev, A. I.; Kondrat'ev, M. I.; Kozyura, A. K.; Ionova, L. K.; Istomina, G. N.; Pankratova, T. N.; Vorob'ev, M. G.; Faer, S. M. 1972. Translated from pp 85-89 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

External β-irradiation in doses in excess of 2,000 rads leads to increase in severity of the pathological process induced by γ irradiation in rats. The degree of increase in biological effect was directly related to the dosage of β and γ irradiation. Iodine-131 administration showed an effect on the course and outcome of acute radiation sickness when given at doses in excess of 50 μCi (24,600 rads). Iodine-131 administered at a dosage of 50 or more μCi and external γ irradiation intensified the severity of skin lesions induced by β irradiation and caused them to present a protracted course. Exposure of the animals to all three radiation factors elicited a complex response reaction in which the influence of each of the agents was manifested the most distinctly at different stages of the development of the pathological process, and was related to the dose levels and ratio. At the initial stage of illness, the effect was essentially due to external γ irradiation, but at the height of illness β irradiation began to add a significant contribution and, to a lesser extent, so did ^{131}I; at the stage of recovery of impaired functions, the consequences of both these factors became decisive. The typical features of this type of lesion are: primary erythema, lesion to the mucosa of the upper respiratory tract and eyes, deterioration of periodicity of the pathological process, change in nature of hematological changes inherent to acute radiation sickness, GI tract disorders, skin lesions, recurrence of symptoms, and protracted repair processes. There was less uptake of ^{131}I in the thyroid following exposure to the three radiation factors than with administration of radioactive iodine alone. (auth)

9861 (AEC-tr-7457, pp 135-148) CHARACTERISTICS OF ACUTE RADIATION INJURY FOLLOWING COMBINED ADMINISTRATION OF RADIOACTIVE IODINE AND WHOLE-BODY γ RADIATION. Strel'tsova, V. N. 1972. Translated from pp 90-100 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Comparative analysis of the effectiveness of single administration of ^{131}I, single whole-body exposure to external γ irradiation, and combined exposures indicated that combined exposure is the most effective with regard both to pathological changes and inhibition of recovery processes in rats. The reaction of radiosensitive tissues was determined by the contribution of the external radiation factor, with regard to forms of damage and nature of recovery processes in the case of a combination of single exposure to internal and external radiation factors. The contribution of ^{131}I was predominant in the pathological reactions of the thyroid, the pituitary hypophysis, and the kidneys. (auth)

9862 (AEC-tr-7457, pp 149-153) SIMULTANEOUS EFFECTS OF ^{60}Co γ RADIATION AND ^{131}I ON MAMMALS. Kalistratova, V. S.; Oksentyuk, G. S.; Kryuk, V. F. 1972. Translated from pp 100-103 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The relation between the intake of ^{131}I and the biological effectiveness of whole-body external γ radiation was studied in rats. Several series of experiments were conducted using a large set of biochemical methods, and followed up animal survival after different types of exposure. A dynamic study was made of metabolism according to the following indices: liver and muscle glycogen, blood sugar, pyruvic acid (PA), total lipids, total cholesterol, β-lipoproteins of blood, as well as blood cholinesterase activity. Analysis of the experimental data showed that with all forms of exposure the reaction of males was more marked than of females, however, the chief patterns of change in several indices were very similar, especially after the 14th day, which is probably related to the fact that at the early stages there is superposition of the nonspecific effect of the internal or external factor. (auth)

9863 (BNL-18881) LYMPHOCYTE REPOPULATION AND RESTORATION OF CELL MEDIATED IMMUNITY FOLLOWING RADIATION: WHOLE BODY AND LOCALIZED IRRADIATION. Cronkite, E. P.; Chanana, A. D.; Joel, D. D.; Laissue, J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 42p. (CONF-740331-2). Dep. NTIS $5.25.

From interaction of radiation and host immune mechanisms of malignancy conference; White Sulphur Springs, West Virginia, USA (23 Mar 1974).

The effects of whole-body, local, and extracorporeal irradiation on lymphocytic populations, cell-mediated immunity, allograft rejection and hematopoietic cell proliferation are reviewed. Emphasis in this review is placed on the heterogeneity of lymphocytes with respect to origin, function, migrational patterns, anatomic distribution, and life span and on the relatively large production rate for thymic and extrathymic lymphocytes. The conclusion is reached that eradication by irradiation of any functional subpopulation of lymphocytes is a practical impossibility. At least a 5 log kill would be necessary to eliminate specific antigen recognition and even a greater log kill would be required in case of allograft recognition. It is pointed out that when measuring irradiation suppression of a cell population it is vitally important that the methods employed establish the reproductive integrity of the cells of interest. Incorporation of DNA precursors as an indication of survival may be misleading. Recovery of lymphoid organs following irradiation is time-dose dependent. Of particular importance, however, is the "degree" of total body exposure. Locally irradiated lymphoid tissues recover rapidly. Bone marrow shielding markedly enhances recovery due apparently to migration into the irradiated tissues of lymphocytic stem cells. Total body irradiation as an immunosuppressant prior to kidney allografting in man is not practical. Irradiation of kidney allografts may however be helpful in preventing rejection crises since the entire process of detection, proliferation, and attack by lymphoid cells can all occur within the graft. Extracorporeal irradiation of blood (ECIB) and/or thoracic duct lymph (ECIL) is effective in depleting the body of the easily mobilizable pool of lymphocytes. There remains, however, a relatively large pool of sessile lymphocytes, which varies in size in different peripheral lymphoid tissues. ECIB has been shown to be moderatively effective in prolonging skin and kidney allografts in animals. ECIL is more effective in prolonging skin allograft rejection particularly if the skin grafts are placed within the drainage bed of the thoracic duct. (auth)

9864 (COO-2000-108) LOW-LEVEL X-IRRADIATION OF THE BRAIN DURING DEVELOPMENT: MORPHOLOGICAL, PHYSIOLOGICAL, AND BEHAVIORAL CONSEQUENCES. Comprehensive Progress Report, June 15, 1962–August 31, 1974. Altman, J. (Purdue Univ., Lafayette, Ind. (USA)). 1974. Contract AT(11-1)-2000. 33p. Dep. NTIS $4.75.

Results are summarized from studies of postnatal neurogenesis and the effects of local x irradiation on the brain of infant rats. Brain tissues obtained at intervals up to 90 days following exposure to fractionated doses of 50 to 400 R or single doses of 200 R during the first two weeks after birth were examined histologically for morphological changes and cell survival. Changes in the biosynthesis of DNA, RNA, and proteins were studied by serial autoradiography following the injection of tritium-labeled adenine, uracil, and leucine. Marked alterations in the morphology of brain cells following irradiation were observed. The effects of irradiation at various doses and dose rates on motor development and behavior were followed during 2.5 years. Studies on cell proliferation in the visual pathways showed a high rate of production of glia cells in the entire visual system associated with degenerative and regenerative processes and the formation of new glial cells in adult rats in presumably unaffected brain areas. (CH)

9865 (COO-3267-6) RADIATION-INDUCED CHROMOSOMAL INVERSIONS IN MICE. Progress Report, 1 June 1973–31 May 1974. Bailey, D. W. (Jackson Lab., Bar Harbor, Maine (USA)). 1974. Contract AT(11-1)-3267. 21p. Dep. NTIS $4.25.

Progress is reported on studies of chromosomal inversions in mice induced by x irradiation or chemical treatment of the sperm. The inversions were detected by observing the frequency of first meiotic anaphase bridges of their sons. (CH)

9866 (COO-3380-16) TUMORIGENIC ACTION OF BETA, PROTON, ALPHA, AND ELECTRON RADIATION ON THE RAT SKIN. Progress Report, August 1, 1973–July 31, 1974. Albert, R. E.; Burns, F. J. (New York Univ., N. Y. (USA). Inst. of Environmental Medicine). 1974. Contract AT(11-1)-3380. 14p. Dep. NTIS $4.00.

The nature of the carcinogenic hazard of radiation and the mechanism of cancer induction was studied by irradiating rat skin in various geometrical and temporal patterns with various types of radiation. Results of studies on tumor incidence following exposure to various sieve and grid irradiation patterns indicated that focal irradiation is less efficient in producing tumors than uniform irradiation for low LET radiation, such as electrons or x rays, while no difference in efficiency was observed for protons. By varying the energy of an electron beam, and hence its penetration, it was found that tumors were produced only if the radiation penetrated sufficiently to reach the level of about 0.3 mm which roughly corresponded to the depth of the hair follicles in the resting (telogen) phase. Several experiments were conducted to elucidate the biological basis for the penetration effect. In relation to the cellular mechanisms involved in radiation carcinogenesis, comparisons were made of the carcinogenic impact of proliferation at the time of and subsequent to irradiation, the relationship of tumor growth rate to appearance time, and the relationship of biological recovery between dose fractions on the tumor growth rate. (CH)

9867 (IAEA-R-625-F) EFFECT OF GAMMA IRRADIATION ON THE LIPID METABOLISM OF RADIOSENSITIVE TISSUES. Final Report, 1 July 1968–30 June 1972. Miras, C. (International Atomic Energy Agency, Vienna (Austria)). Jun 1972. 5p. INIS.

It was established that bone marrow cells of rabbits kept in short-term cultures were able to synthesize lipids, including neutral lipids as well as glyco- and phospholipids. Irradiation of animals with a dose of 500 R resulted in an increase of lipogenesis in bone marrow. Incorporation of both glucose-^{14}C(u) and palmitate-I-^{14}C into all separated fractions of neutral lipids, i.e. tryglycerides, mono- and diacyl glyceryl ethers, was found significantly enhanced. Synthesis of tryglycerides, which comprise the major part of neutral lipids, was particularly increased. Data on incorporation of glucose-^{14}C(u) and of galactose-I-^{14}C confirmed that biosynthesis of glycolipids was equally enhanced. The effect of irradiation on phospholipid biosynthesis was studied by the use of glucose-^{14}C(u) and palmitate-I-^{14}C precursors. Incorporation into phospnatidyl choline, which is the major product of phospholipid biosynthesis, was enhanced to a considerably higher extent by irradiation than into other phospholipids, such as phosphatidyl ethanolamine, phosphatidyl serine, and phosphatidyl inositol. Contrary to the experimental results obtained in vivo irradiation of animals, lipid biosynthesis from both glucose-^{14}C(u) and palmitate-^{14}C as well as production of carbon dioxide from palmitate were not significantly affected by exposure of bone marrow cells in vitro to the same dose of radiation (500 R). In fact, glucose oxidation was even inhibited to about half of the control value. Therefore, it was supposed, that alterations produced by in vivo irradiation in lipid metabolism were rather the result of a more complicated mechanism, than that of a direct effect on bone marrow cells. Finally, studies on sphingoglycolipid content and composition of various radiosensitive tissues (bone marrow, thymus, and spleen) as well as of relatively radioresistant ones (liver and kidney) were carried out to explore if damages induced by ionizing radiation in plasma membrane matrix are involved in the radiation injury of cells. These experiments demonstrated an equal decrease in the sphingoglycolipid content of plasma membranes isolated from thymus and liver 12 hours following irradiation of animals, but the composition of these complex lipids changed in the thymus more significantly than in the liver. Glycolipid content and composition remained unchanged in bone marrow cells and kidney tissue, however, both of these parameters were greatly modified in the spleen. Contrary to the thymus, the small glycolipids were predominantly affected by irradiation in this organ. (INIS)

9868 (IAEA-R-788-F) BIOCHEMICAL EVALUATION OF SHIR-KHESHT, A NATURAL NONTOXIC CHEMICAL PROTECTOR. Final Report, 1 November 1969–30 June 1972. Rouhanizadeh, N. (International Atomic Energy Agency, Vienna (Austria)). Oct 1972. 5p. INIS.

The radioprotective action of a natural substance Shirkhesht was studied by a simple biochemical evaluation of the DNP complex of the irradiated animals prior and after application of Shirkhesht. The sensitivity of the DNP complex of the irradiated

lymphopoietic tissues has also been investigated. It was concluded that considerable changes occur in the DNP complex of the irradiated animals. Shirkhesht appears to moderate these changes to an appreciable extent. (INIS)

9869 (IAEA-R-841-F) NEW RADIOSENSITIZING AGENTS; STUDIES ON THEIR MODE OF ACTION AND THEIR USE IN THE RADIOTHERAPY OF CANCER. Final Report, 1 January 1970–31 December 1972. Kiricuta, I. (International Atomic Energy Agency, Vienna (Austria)). Nov 1972. 55p. INIS.

Of 25 new compounds synthesized, the following three thymine analogues exhibit radiation enhancing effect: 5-amino-2, 4-diketo-6-hydroxy-5-methyl-perhydropyridine hydrazine, 5-amino-2, 4-diketo-6-hydroxy-5-methyl-perhydropyrimidine hydrochloride, and 5-amino-2, 6-dihydroxy-5-methyl-4-keto-3,5,6-hydropyrimidine disodium salt. Toxicological examinations have shown that these compounds have little or no toxic effects. Enhancement of response to irradiation by the new thymine analogues depends on the biologic system used. Based on the comparison of ^{59}Fe incorporation into red cells of untreated rats irradiated with 500 R and of rats pretreated with the compounds before irradiation, the following conclusions were drawn: the radio-iron incorporation; at 3 days after irradiation was significantly reduced in all the studied groups, at 7 days there was a progressive improvement in all groups and at 14 days after irradiation, the values were normal in all the groups. (INIS)

9870 (N-73-16038) ROLE OF DEPRESSED METABOLISM IN INCREASED RADIORESISTANCE. Semiannual Status Report. Musacchia, X. J. (Missouri Univ., Columbia (USA)). 14 Sep 1972. 81p. NTIS $6.25.

Studies are presented of the physiology of depressed metabolism, radioresistance in depressed metabolic states, comparative aspects of depressed metabolism, and gastrointestinal responses to ionizing radiation. Specific data cover helium-cold induced hypothermia in white rats and hamsters, and radiation responses and intestinal absorption in the gerbil. (STAR)

9871 (SGAE-2271) DETERMINATION OF DNA REPAIR PROCESSES IN PERFUSED ORGANS. Hruby, R. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Apr 1974. 7p. (In German). Dep. NTIS (US Sales Only) $4.00.

To determine any differences in the repair capacity of different organs and tissues, the repair processes in isolated organs were investigated to serve as a guide for later in vivo experiments. In contrast to the whole animal, it is easier to induce experimental damage in single isolated organs, which later leads to a measurable ^{3}H-thymidine incorporation as a criterion for unscheduled DNA-synthesis. Unfortunately the method is not yet optimum developed for all organs and thus no quantitative statements regarding a single organ can be made at the moment. However, the results up to date indicate that this experimental procedure is suitable for determining qualitative differences in the repair capacity of various tissues in one organ. (auth)

9872 (UR-3055-9) ERYTHROPOIETIN AND MACROCYTIC ERYTHROPOIESIS IN NORMAL AND X-IRRADIATED DOGS. Kaufman, G. E. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1974. 145p. Dep. NTIS $10.25. Thesis.

Sublethal whole-body x-irradiation had no detectable effect on the relationship between percentage anemia and erythropoietin (Ep) titer in dogs. This indicated that x-irradiation has little or no effect on Ep production or on the disappearance of erythropoietin from the plasma. Since x-irradiation results in bone marrow hypoplasia, bone marrow cellularity does not appear to be related to disappearance of erythropoietin from the blood plasma. Macrocytic erythropoiesis was observed during recovery from x-irradiation and from x-irradiation plus blood loss. In all cases where macrocytic erythropoiesis was observed the period of macrocyte production coincided with a period of increased erythropoiesis. This supports the hypothesis that a single agent is responsible both for stimulating increased erythropoiesis and for the formation of macrocytic erythrocytes. (230 references) (auth)

9873 LYMPHOID CELL DEPENDENCE OF EOSINOPHIL RESPONSE TO ANTIGEN. IV. Effects of In Vitro X Irradiation on Adoptive Transfer of Anamnestic Cellular and Humoral Responses. Ponzio, N. M.; Speirs, R. S. (Downstate Medical Center, Brooklyn). Proc. Soc. Exp. Biol. Med.; 145: No. 4, 1178-1180(Apr 1974).

Memory for the eosinophil and antitoxin responses to tetanus toxoid exhibits distinct sensitivities to in vitro x irradiation. Memory cells mediating the antitoxin response are inhibited by doses greater than 100 R, whereas doses greater than 400 R are required to inactivate memory cells associated with the eosinophil response. The similarity in the radiosensitivity of cell-mediated and eosinophil responses further supports the association of these two expressions of immunity. We have described experiments in which both cell-mediated (eosinophil) and humoral (antitoxin) responses to a single antigen (tetanus toxoid) can be conveniently monitored in the same animal model. (auth)

9874 CHROMOSOME ABERRATIONS IN SPERMATOCYTES AND OOCYTES OF MICE IRRADIATED PRENATALLY. Tsuchida, W. S.; Uchida, I. A. (McMaster Univ., Hamilton, Ont.). Mutat. Res.; 22: No. 3, 277-280(Mar 1974).

Five pregnant mice were exposed to a single dose of 150 R whole-body γ irradiation on the 12th day of gestation. The oocytes and spermatocytes, collected from the F_1 progeny at ages 10 to 12 weeks, were examined for chromosome aberrations in metaphase I and compared with those of the progeny of non-irradiated controls. No differences were found in the type and frequency of aberrations between irradiated and controls nor between the sexes. It appears, therefore, that either primordial germ cells of both males and females are fairly resistant to radiation or an efficient selection or repair mechanism has eliminated the aberrant cells. (auth)

9875 IMPAIRED ELKIND RECOVERY IN HEMATOPOIETIC COLONY-FORMING CELLS OF AGED MICE. Chen, M. G. (Oak Ridge National Lab., TN). Proc. Soc. Exp. Biol. Med.; 145: No. 4, 1181-1186(Apr 1974).

Spleen colony-forming cells (CFU) in the bone marrow of old mice (25 to 27 months) are deficient in their ability to recover from fractionated sublethal doses of X-rays in vivo. This lack of repair is not evident from single-dose radiation survival data. Fractionation survival curves suggest that old CFU which survive the first dose of fractionated radiation may not be as radioresistant as comparable young (3 months) survivors. (auth)

9876 DEVICE FOR THE UNIFORM IRRADIATION OF SMALL ANIMALS IN A HORIZONTAL RADIATION BEAM. Wilson, J. D.; Montour, J. L.; Miller, G. E. (Medical Coll. of Virginia, Richmond). Int. J. Appl. Radiat. Isotop.; 25: No. 5, 235-236(May 1974).

A simple remote-controlled apparatus has been designed to obtain uniform whole-body irradiation of groups of small animals in a horizontal radiation beam. The animals are confined in individual cylindrical chambers bored in a solid Lucite wheel. A removable circular Lucite plate is attached to each face of the wheel with a pressure-fit nylon hub. These serve to restrain the animals and allow maximum dose build-up outside of the animals. In use the wheel is centered in the beam and rotated during the exposure in order to average inhomogeneities in the beam. When half of the desired total dose has been given, the wheel is turned 180° about its vertical axis so that the opposite face is presented to the beam for the remainder of the exposure. Thus, the animals are irradiated in opposite directions along their long axes. Lucite, although heavy and costly, was found necessary to allow the animals to be exposed as part of a large nearly tissue-equivalent mass providing secondary equilibrium. (UK)

9877 CELLULAR BASES FOR RELATIVE RADIORESISTANCE OF THE ANTIBODY-FORMING SYSTEM AT ADVANCED STAGES OF THE SECONDARY RESPONSE TO TETANUS TOXOID IN MICE. Grobler, P.; Buerki, H.; Cottier, H.; Hess, M. W.; Stoner, R. D. (Univ., Bern). J. Immunol.; 112: No. 6, 2154-2165(Jun 1974).

Nearly normal secondary tetanus antitoxin responses were produced by young adult female mice subjected to 600 rads of ^{60}Co gamma whole-body radiation 4 days after secondary antigenic stimulation via the hind leg footpads. In an attempt to correlate the rapid transition from radiosensitivity of the antibody-forming system on day 3 to relative radioresistance on day 4 after booster, we carried out studies on cytokinetics in regional (popliteal) lymph nodes and on incorporation of ^{3}H-L-histidine into circulating antitoxin. Analyses of tritium radioactivity in antigen-antibody precipitates of pooled sera 2 h after i.v. injection of the labeled amino acid revealed maximum incorporation into antibody around day 7 after booster in nonirradiated controls, and around day 12, i.e., 8 days after radiation, in experimental mice, respectively. Relative radioresistance of the antibody-forming system on day 4 after booster, as opposed to day 3, was attributed to the finding that plasmacellular proliferation in medullary cords reached a marked and narrow peak on day 3 and had almost subsided to control levels between days 4 and 5. Accordingly, many medullary plasma cells survived and continued to proliferate after exposure to radiation. In contrast, germinal centers, which largely determine the overall maximum DNA synthetic activity in the lymph node and attain their full development in non-irradiated animals only 5 to 6 days after booster, were completely destroyed by radiation within 1

day. Since antibody production persisted despite the disappearance of germinal centers; and mice irradiated 4 days after booster have previously been shown to lack tertiary responsiveness, the present findings lend strong support to the hypothesis that germinal center cells were involved more in the generation of memory cells than in active antibody secretion. The results do not favor the assumption of a marked contribution of germinoblasts to the antibody-forming plasma cell population elicited by the same stimulus which had triggered germinal center formation. (auth)

9878 EFFECTS OF IRRADIATION ON THE SKELETON. Vaughan, J. M. New York; Oxford University Press (1973). 308p. $29.50.

The effects of skeletal irradiation are discussed under the following headings: radiation and the skeleton; structure and physiology of the skeleton relevant to irradiation; skeletal tissues at risk from irradiation; histopathology of tumors induced by irradiation of the skeleton; external irradiation; internal irradiation from the bone-seeking radionuclides; radium isotopes; strontium isotopes; plutonium isotopes; americium; thorium isotopes; ^{32}P; and other bone-seeking radionuclides. (ERB)

9879 MODIFICATION OF THE CENTRAL NERVOUS SYSTEM SYNDROME IN HEAD-IRRADIATED RABBITS WITH PHARMACOLOGIC AGENTS. Nair, V.; Mackie, J. D. (Univ. of Health Sciences, Chicago). Radiat. Res.; 58: No. 3, 373-383(Jun 1974).

The central nervous system effects of head irradiation (10,000 R) in rabbits were investigated. The irradiated rabbits showed a wide spectrum of neurological defects including ataxia, dystonia, and nystagmus. The rabbits were in seizures soon after irradiation and the ability to assume normal posture was never regained. The median survival time at the dose employed was 27 hr, some dying even within minutes after radiation. It was found that administration of the anticonvulsant drugs acetazolamide or diphenylhydantoin within 1 hr after radiation afforded protection against the morbidity and significantly prolonged the survival time (median survival time, 7 to 8 days). In analyzing the factors underlying the eventual death in the drug-protected and irradiated rabbits, the hitherto identified modes of radiation syndrome such as oral radiation, hematopoietic and gastrointestinal radiation syndromes did not play a role. Infection also did not appear to be a contributory factor. These results suggest the possibility of a hitherto unidentified mode of radiation death—a delayed CNS death—in the drug-protected and irradiated rabbits. (auth)

9880 POSSIBILITY THAT DNA REPAIR IS RELATED TO AGE IN NON-DIVIDING CELLS. Wheeler, K. T.; Lett, J. T. (Colorado State Univ., Fort Collins). Proc. Nat. Acad. Sci. U. S. A.; 71: No. 5, 1862-1865(May 1974).

Possible age-related deterioration in the efficacy of DNA repair was investigated in a complement of non-dividing mammalian cells which is not replenished during the lifetime of the animal. Internal granular-layer neurons were extracted from the cerebella of beagle dogs, aged from 7 weeks to 13 years, following exposure in situ to 4700 rads of collimated ^{60}Co gamma rays. The alkaline sucrose-gradient sedimentation profiles obtained from the DNA of those neurons after various post-irradiation periods in situ can be interpreted: (a) that there is not an age-associated decrease in the ability of the cells to rejoin the single-strand breaks induced by radiation, but (b) that there may be an age-associated decline in the size of the DNA-containing species which can be extracted from unirradiated cells. The latter effect may reflect normal aging of the cerebellum. (auth)

9881 ROLE OF HISTAMINASE AND CORTICOSTERONE ON THE DEPLETION OF TISSUE HISTAMINE IN THE IRRADIATED RATS. Kobayashi, S. (National Inst. of Radiological Sciences, Chiba, Japan). Proc. Soc. Exp. Biol. Med.; 146: No. 1, 25-29 (May 1974).

The relationship between histamine contents and histaminase activities of the liver, small intestine, kidney, blood plasma, and lung of rats exposed to 650 R of whole-body x irradiation was examined. There was no correlation between these parameters in the liver and small intestine. In contrast, a negative correlation between these parameters was found in the kidney and the lung at 2, 4, and 7 days after irradiation. In particular, the histaminase activity of the lung increased significantly during the first few days after irradiation, reaching the maximum level of 200% of the control on day 4, and returned to the control level by day 7. Concomitantly, a gradual decrease in the histamine content in this organ was observed. Another important observation relates to the role of adrenocortical function on the activation of lung histaminase. Histaminase activity of the lung, which normally increased after irradiation of the intact rats, failed to increase when the animals had been adrenalectomized prior to the exposure to radiation. Data also showed that the activity of this enzyme elevated significantly when adrenalectomized rats were administered with corticosterone for 3 days. On the basis of these observations, significant roles of corticosterone and histaminase in the depletion of tissue histamine from irradiated rats were discussed. (auth)

9882 RADIATION MODIFYING EFFECT OF THE FREE RADICAL NORPSEUDOPELLETIERENE-N-OXYL ON NORMAL BONE MARROW STEM CELLS IN VITRO AND IN VIVO. Blackett, N. M.; Wooliscroft, W. E.; Fielden, E. M.; Lilliicrap, S. C. (Inst. of Cancer Research, Sutton, Eng.). Radiat. Res.; 58: No. 3, 361-372(Jun 1974).

The sensitization of anoxic bone marrow stem cells irradiated in vitro in the presence of the free radical norpseudopelletierene-N-oxyl (NPPN) was demonstrated. No sensitization, however, was obtained following administration to animals which were then killed before irradiation so as to render the stem cells anoxic. Electron spin resonance measurements demonstrated a rapid disappearance of NPPN from blood, which could explain the failure to sensitize anoxic stem cells in intact animals. Measurements in vitro showed that NPPN is degraded by red blood cells. The rate of degradation was not sufficient to explain the loss in vivo indicating that NPPN is probably being degraded by some other tissue. The in vitro reaction kinetics suggest that an enzymatic process may be involved. Another nitroxyl, triacetoneamine, was found to be degraded much more slowly by blood in vitro. (auth)

9883 RADIATION-INDUCED CHANGES IN THE ACTIVITY OF BRAIN ENZYMES INVOLVED IN NEUROTRANSMITTER METABOLISM. Catravas, G. N.; McHale, C. G. (Armed Forces Radiobiology Research Inst., Bethesda, MD). Radiat. Res.; 58: No. 3, 462-469(Jun 1974).

Sprague–Dawley adult male rats were exposed to incapacitating doses of mixed gamma–neutron radiation in a single pulse from the AFRRI-TRIGA reactor. The activities of the enzymes choline acetyltransferase (ChAc), acetylcholinesterase (AChE), monoamine oxidase (MAO), and RNA polymerase (RNAp) were determined in the cerebral cortex, cerebellum, and hippocampus. It was found that as early as 4 min after irradiation of the animal the activity of MAO was markedly decreased in all three brain areas investigated. ChAc and RNAp activities were also decreased but to a lesser extent. No appreciable changes in the activity of AChE were observed. (auth)

9884 CORRELATION BETWEEN CIRCULATING STEM CELL COUNT AND STEM CELL REGENERATION IN LOCALLY IRRADIATED BONE MARROW. Feher, I.; Antal, S.; Gidali, J. (National Research Inst. for Radiobiology and Radiohygiene Budapest). Radiat. Res.; 58: No. 3, 516-523(Jun 1974).

Stem cell regeneration in 650 R locally irradiated mouse bone marrow was studied as a function of the blood CFU level. The number of circulating stem cells was kept at a low level by total body irradiation (the locally irradiated tibia excepted) or at a high level by repeated endotoxin injections. A certain correlation between the number of circulating CFU and regeneration of CFU in locally irradiated bone marrow has been found. In the locally irradiated tibias of otherwise nontreated mice, with slightly elevated blood CFU level, CFU content was 38% of the normal value on day 12 after irradiation. In the experimental groups with a blood CFU level lower than the normal, 5 to 17% CFU regeneration was found. In mice with a circulating CFU number two to three times higher than the normal, CFU regeneration reached 53% of the normal level. A possible role of circulating CFU in the regeneration of locally irradiated, partially damaged bone marrow is suggested. (auth)

9885 EARLY RECOVERY FOR INTESTINAL STEM CELLS, AS A FUNCTION OF DOSE PER FRACTION, EVALUATED BY SURVIVAL RATE AFTER FRACTIONATED IRRADIATION OF THE ABDOMEN OF MICE. Wambersie, A.; Dutreix, J.; Gueulette, J.; Lellouch, J. (Cancer Inst., Louvain, Belg.). Radiat. Res.; 58: No. 3, 498-515(Jun 1974).

The additional dose D_r necessary to reach a given biological effect, when a fraction D_s is split into two equal "subfractions" $2D_i$ separated by an interval of time i, has been studied as a function of the dose per fraction D_s. LD_{50} of mice, scored 20 to 30 days after irradiation on the abdomen, has been chosen as biological endpoint ("intestinal death"). When smaller doses per fraction, D_s and $2D_i$ were studied, they had to be delivered N times ($N \times D_s$ or $N \times 2D_i$), the number of fractions N being adapted to their size in order to reach a suitable rate of survival. The overall treatment time for each compared protocol was kept constant. Intervals i between the two subfractions $2D_i$ of 3.5 and 24 hr were studied. No significant difference appeared in the variation of D_r as a function of D_s related to interval i for the two considered intervals. For i = 3.5 hr, additional dose $D_r = 2D_i - D_s$ may be ascribed mainly to a difference in cellular repair (Elkind repair) between the compared radiation regimes or, in other words, D_r may be considered as the differential recovered dose related to cellular repair when a fraction D_s is split into two equal subfrac-

tions $2D_1$ separated by an interval i. D_r was found to be very small for the doses per fraction currently used in radiotherapy ($D_1 \leq$ 300 rad). It increases rather rapidly when D_1 exceeds 400 rad and reaches about 300 rad for $D_1 \simeq 1000$ rad. On the other hand, variation of D_r as a function of D_1 was not very different for intestinal death and the other gross criteria we have investigated: skin reactions on mice, skin reactions on patients, tumor regression on patients. A differential effect related to fraction number is then unlikely between these tissues in the usual conditions of radiotherapy. Finally, in a fractionated radiation treatment, the total dose corresponding to a given effect does not depend very much on the number of fractions, provided that the overall time is kept constant and that the doses per fraction do not exceed 300 rad. (auth)

9886 EPIDERMAL CHANGES PRODUCED BY WHOLE ANIMAL EXPOSURE WITH LOW-ENERGY ACCELERATED HELIUM IONS. Leith, J. T.; Welch, G. P.; Schilling, W. A.; Tobias, C. A. (Univ. of California, Berkeley). Radiat. Res.; 58: No. 3, 524-540 (Jun 1974).

Some effects of low-energy accelerated helium ion irradiation of essentially the whole skin surface of the mouse (penetration depth 51 mg/cm^2) have been investigated, using doses ranging from 75 to 2800 rads delivered in a single exposure. At this penetration depth, dose-response relationships were obtained for moist desquamation and mortality. For the moist desquamation reaction, 50% of the mouse surface area was involved at a dose of 2918 rads and extrapolation of the moist reaction curve to zero percent skin involvement yields a threshold dose of 1132 rads. Mortality of mice was found with helium-ion doses of 1600 rads or more with an $LD_{50(60)}$ value of 2660 rads. This $LD_{50(60)}$ value corresponds to involvement of about 43% of the mouse surface in a moist reaction. Mortality occurred between 22 and 42 days postirradiation. The mean survival time of the mice varied between 28.5 and 32.0 days. No dependence of survival time on dose was found. Skin reactions were first seen at about 15 to 20 days postirradiation, and maximal skin involvement occurred at about 28 days postirradiation for the moist reaction. Changes in epidermal cell nuclear volumes and mitotic indices were also measured as a function of dose and time postirradiation. (auth)

9887 EFFECTS OF WHOLE-BODY GAMMA IRRADIATION ON VARIOUS LIFE STAGES OF THE TOAD, BUFO WOODHOUSEI FOWLERI. Landreth, H. F.; Dunaway, P. B.; Cosgrove, G. E. (Oak Ridge National Lab., TN). Radiat. Res.; 58: No. 3, 432-438 (Jun 1974).

Adult, juvenile, and tadpole Fowler's toads were exposed to graded doses of whole-body gamma radiation. Radiation mortality, time of lethality, and changes in behavior and development were studied for 50 days or more. The estimated $LD_{50/30}$ for adults was 2329 rad, for juveniles uncertain but near 1000 rad, and for tadpoles 1670 rad. The estimated $LD_{50/30}$ for adults was 1780 rad and for juveniles and tadpoles approximately 100 rad. At most lethal radiation doses, adults survived much longer than tadpoles, and tadpoles longer than juveniles. Irradiated tadpoles failed to metamorphose. Behavioral changes were noted in irradiated toads of all stages. Damage to hemopoietic tissues was the prominent pathologic feature in all three life stages. Skin necroses, hemorrhage, bacterial invasion of tissues, and atrophied ovaries were observed in irradiated adults. Irradiation effects in other amphibians are reviewed. (auth)

9888 LONG-TERM EFFECTS OF X IRRADIATION ON THE ABILITY OF THE SPLEEN TO SUPPORT CLONOGENIC PROLIFERATION. Nelson, D. F.; Chaffey, J. T.; Hellman, S. (Harvard Medical School, Boston). Radiat. Res.; 58: No. 3, 417-431 (Jun 1974).

A modified spleen colony method was used to measure the functional ability of the irradiated spleen to support clonogenic proliferation. This was assayed by counting the number of exogenous colonies formed by normal bone marrow cells injected into recipient mice whose spleens had previously been irradiated. A shallow dose-related decrease in the ability of irradiated mouse spleen to support clonal growth was seen at all times after splenic irradiation. These dose-response relationships do not resemble the usual clonogenic survival curves. The reduction in colony number produced by normal bone marrow cells did not decrease below 0.4 even when the recipient spleen had received as much as 3000 rads. Recuperation of the ability of irradiated mouse spleen to support clonal growth was observed at intervals of 6 and 9 mo. This appeared to be a temporary recuperation, since a second reduction was seen at 12 mo. An absence of repair was demonstrated when 2000 rads was fractionated into two doses delivered 6 hr to 7 days apart. (auth)

9889 X-RAY INACTIVATION OF MURINE BONE MARROW CELLS AS MEASURED BY THE SPLEEN COLONY ASSAY AND THE DIFFUSION CHAMBER TECHNIQUE. Pettersen, E. O.; Boyum, A.; Laane, B. F. M. (Norwegian Defense Research Establishment, Kjeller). Radiat. Res.; 58: No. 3, 409-416(Jun 1974).

The x-ray response of murine hematopoietic stem cells was studied using the diffusion chamber (DC) technique and the spleen colony technique. The survival curves indicated that 7-day DC-culturing measures two different types of progenitor cells, one relatively radioresistant with D_0 of 162 rad and one with radiosensitivity comparable to that of CFUs (60 rad). (auth)

9890 ELEVATION OF BODY TEMPERATURE IN RABBITS BY X-IRRADIATION OF THE TRUNK. Veninga, T.; Diekema, A. (State Univ. Groningen, Netherlands). Life Sci.; 14: No. 9, 1777-1784(1 May 1974).

Rabbits, irradiated with moderate doses of x rays on their trunk exhibit a hyperthermic response. Evidence is presented that this temperature response is mediated by leukocytic pyrogen. (auth)

9891 EVALUATION OF THE ERYTHROPOIETIC ACTIVITY IN SYNGENIC RADIOCHIMERA. Silini, G.; Briganti, G.; Gallini, R. (CNEN, Rome). Haematologica (Pavia); 58: 451-469(1973). (In Italian). (RT/BIO-(73)22).

The use of ^{59}Fe tracer techniques under well controlled conditions was effective for the evaluation of the erythropoietic function in mice lethally x irradiated and injected with different numbers of syngeneic bone-marrow cells. The data reported show that within 13 days after irradiation and bone marrow transplantation the spleen is the main erythropoietic organ and it produces mature erythrocytes as a function of the number of cells initially injected. The 24-hr uptake of ^{59}Fe in the circulating blood of the injected mice may be regarded as a simple and rapid test of the erythropoietic activity of bone-marrow cell suspensions and may be used to estimate simple kinetic parameters of the progenitor cells. (auth)

9892 DOSIMETRY IN RABBIT LYMPH NODES AFTER ENDOLYMPHATIC THERAPY WITH RADIONUCLIDES. Magnus, L. (Essen Univ.). Strahlentherapie; 146: No. 5, 566-575(Nov 1973). (In German).

A film dosimetry method is described, which makes possible accurate quantimetry in the extirpated lymph nodes after endolymphatic radiotherapy. Hereby, dose peaks of only 0.5 mm distance can be differentiated and measured. Calibration of the films is made by a cobalt-60 source. A blackening factor due to the activity must be considered. Practical experiences were made in the endolymphatic therapy of rabbits; 17 animals got P-32-tri-N-octyl-phosphate, 15 animals Iodine-125-triolein. (auth)

9893 SEROLOGICAL AND PATHOMORPHOLOGICAL ASPECTS OF AUTOIMMUNIZATION IN EXPERIMENTALLY INDUCED TUBERCULOSIS IN GUINEA PIGS EXPOSED TO FRACTIONATED GAMMA-IRRADIATION AND ISONIAZIDE TREATMENT. Vylchanov, V.; Vasilev, V.; Kekhajov, I. Izv. Mikrobiol. Inst., Bulg. Akad. Nauk.; 23: 101-109(1972). (In Bulgarian).

Studies were carried out to elucidate the role of small doses of gamma rays (fractionated exposure) in the autoimmunization process in guinea pigs experimentally infected with Mycobacterium tuberculosis $H_{37}R_v$. The experiments involved six groups of 10 animals each. Higher frequency of complement-fixing and hemagglutinating autoantibodies to lung, brain, and testicular tissues was found in the guinea pigs experimentaliy infected with tuberculosis and subjected to fractionated irradiation in comparison with the non-irradiated infected animals. This indicates that small doses of gamma rays of the order of 10 R become of significance when summed up in the aggravation of the autoimmunization process induced during experimental tuberculosis. The treatment with isoniazide decreased the frequency of induced autoantigenicity and the formation of tissue autoantibodies. (auth)

9894 MYELOGENOUS LEUKEMIA AND RELATED MYELOPROLIFERATIVE DISORDERS IN BEAGLES CONTINUOUSLY EXPOSED TO ^{60}Co γ-RADIATION. Fritz, T. E.; Norris, W. P.; Tolle, D. V. (Argonne National Lab., IL). Bibl. Haematol.; No. 39, 170-188(1973).

From fifth international conference on comparative leukemia research; Padua, Italy (1971).

Young adult beagles of both sexes are being exposed continuously to whole-body γ radiation from a ^{60}Co source at rates varying from 5 to 300 R/22-hour exposure day. Thus far, dogs at the lowest exposure were irradiated for up to 1,200 days. All deaths resulted from damage to the hematopoietic system, manifested as three distinct syndromes: septicemia, anemia, and myeloproliferative disease (MPD), usually in the form of myeloid leukemia. The causes of death are related to the exposure rate and total accumulated dose, which are reflected in the time of survival. At exposure rates of 35 R/day and above, all deaths result from septicemia, but septicemia does not occur at 10 R/day or less.

At 17 R/day all three terminal syndromes are seen. At 10 and 5 R/day, only anemia and MPD are seen with MPD occurring at significantly longer times of exposure. When exposed till death at 17 R/day, 2 of 13 decedents had MPD after a mean 1,038 days of irradiation, while at 10 R/day 6 of 13 decedents had MPD after a mean of 719 days of irradiation. Only 6 of 24 dogs being irradiated at 5 R/day have died; 4 had MPD at a mean of 1,063 days. These results demonstrate that the response of bone marrow varies with both dose rate and total dose. The data show that hematopoiesis in beagles, judged by peripheral blood values, tends to equilibrate with continuous irradiation, particularly at rates of 5 to 10 R/day. Myeloid leukemia and related MPD were observed only in those dogs whose blood values indicated such an attempt at equilibration. (auth)

9895 ASSOCIATION OF VIRUS IN RADIATION AND CHEMICAL LEUKEMOGENESIS IN RATS AND MICE. Yokoro, K.; Imamura, N.; Kajihara, H.; Nakano, M.; Takizawa, S. (Hiroshima Univ.). Bibl. Haematol.; No. 39, 603-616(1973).

From fifth international conference on comparative leukemia research; Padua, Italy (1971).

A comparative study of chemical and radiation leukemogenesis was carried out in mice and rats. The results obtained from this study indicated that there seems to be a common mechanism for both chemical and radiation leukemogenesis in mice. In both instances, the direct inducer is Gross type virus, and carcinogenic chemicals or radiation merely provide a favorable condition for a sufficient interaction of the virus and its target cells, and the proliferation of antigenically altered leukemic cells most likely through their immunosuppressive effect on the host. On the other hand, the mechanism involving leukemogenesis in rats appears to be different from that in mice. In rats, there has been no evidence for viral implication and the mechanism remains to be determined. (auth)

9896 ROLE OF IMMUNITY IN RADIATION LEUKEMOGENESIS. Haran-Ghera, N. (Weizmann Inst. of Science, Rehovoth, Israel). Bibl. Haematol.; No. 39, 671-676(1973).

From fifth international conference on comparative leukemia research; Padua, Italy (1971).

The susceptibility of C57BL/6 mice to radiation leukemogenesis is age-dependent, the leukemia incidence decreasing with age increase. The thymus anatomy did not seem to be responsible for this decrease in tumor incidence. Since the leukemogenic virus is present in normal C57BL/6 mice, it is proposed that natural immunization occurs in older mice, and thereby reduces the susceptibility to radiation leukemogenesis with age increase. (auth)

9897 INFLUENCE OF THE THYMUS AND OF ALS ON RADIATION LEUKEMOGENESIS. van Bekkum, D. W.; Balner, H. (Radiobiological Inst. TNO, Rijswijk, Norway). Bibl. Haematol.; No. 39, 677-688(1973).

From fifth international conference on comparative leukemia research; Padua, Italy (1971).

In the C57BL strain of mice, its (CBA × C57BL)F_1 hybrid and in RFM mice sublethal whole-body irradiation induced early appearance of lymphomas which seemed to be thymus dependent. Irradiation of thymectomized F_1 hybrids resulted in a substantial incidence of lymphatic tumors which developed 5 to 10 months later than the thymus dependent lymphomas. Renal subcapsular implants of newborn thymus did not influence the incidence of lymphoid tumors, but reticular cell tumors were less frequent in the thymectomized animals receiving thymus implants. (auth)

9898 SWIM-TANK MEASUREMENT OF RADIATION-INDUCED BEHAVIORAL INCAPACITATION. Casarett, A. P. (Cornell Univ., Ithaca, NY). Psychol. Rep.; 33: 731-736(1973).

A swim tank was designed to measure behavioral incapacitation in rats. A preliminary experiment is reported in which the swim tank was used to identify both the phase of early transient incapacitation and that of permanent complete incapacitation which occur after a supralethal pulse of mixed neutron and gamma radiation. (auth)

9899 EFFECT OF IRRADIATION OF AMINO ACID IN VITRO INCORPORATION IN THE COURSE OF LIVER REGENERATION. Tasheva, B.; Markov, G.; Tsanev, R. (Biochemical Research Lab., Sofia). Z. Naturforsch.; 28c: 313-315(1973).

The in vitro incorporation of ^{14}C-leucine by rat liver microsomes was studied under four different physiological states: normal liver of adult rats (NL), irradiated (4,000 rads) liver (IL), liver after partial hepatectomy (RL), and regenerating liver in preirradiated rats (IRL) 2, 5, 12, and 24 hours after treatment. Both irradiation and partial hepatectomy, when applied separately, stimulate the endogenous activity of microsomes, whereas preirradiation abolishes the stimulatory effect in the early hours after partial hepatectomy. The results are in agreement with the concept that irradiation stimulates the operating synthetic program of the cell and inhibits cellular reprogramming. (auth)

9900 INCORPORATION OF TRITIUM-URIDINE IN RNA OF THE ISOLATED PERFUSED RAT LIVER AFTER IRRADIATION IN VITRO. Koenig, K.; Staehler, F.; Baisch, H.; Voelcker, R. (Hamburg Univ.). pp 14-17 of Radiation Biophysics, Free Radicals. Vol. II. Broda, E. (ed.). Vienna; Wiener Medizinische Akademie (1971).

From first European biophysics congress; Baden, Austria (14 Sep 1971).

X-ray irradiation of the isolated perfused rat liver was performed in order to study radiation-induced changes in RNA metabolism. Tritium-uridine was added to the perfusion medium and its incorporation in RNA was studied. The total amount of tritium-uridine incorporated in RNA is increased after irradiation, depending on the radiation dose and the perfusion time. At the same time the specific activity of the labeled RNA-fraction decreases. This shows that the increase in RNA-synthesis after x-ray irradiation in vivo is not due to an increase in the number of binding sites of the DNA-dependent RNA-polymerase, but rather to hormonal action. (INIS)

9901 VARIATIONS IN CELL KINETICS AND GROWTH RATE IN AN EXPERIMENTAL TUMOR DURING NATURAL GROWTH AND AFTER IRRADIATION. Hermens, A. F. Amsterdam; Univ. Amsterdam (1973). 189p.

Thesis.

In order to obtain a better insight into factors determining clinical radiation effects on tumors, variations in cell kinetics during natural growth and growth after irradiation were studied for an experimental R-1 rhabdomyosarcoma in the rat. Cell kinetic parameters were studied by the ^3H-Tdr pulse labelling technique and autoradiography. In the irradiation experiments the tumors received a single dose of 2000 rad of 300 kV x rays. Fractions of clonogenic cells were assayed before and after irradiation by quantitative plating in vitro of isolated cells in suspensions prepared from the tumors. It is concluded, among others, that there is little increase in the duration of the cell cycle time as compared with the large increase in the doubling time, the duration of which increases progressively when a tumor grows larger than 1000 mm^3. The clinical radiation effect on tumors can be described by a parameter designated as the specific growth delay i.e. the ratio of the observed growth delay and the volume doubling time at the moment of irradiation. According to this parameter, the data for cell kinetic parameters and for the clinical radiation effect obtained for different types of tumors that were irradiated with different doses indicate that the radiation induced delay increases with increasing growth fraction and with increasing percentage radiation induced cell loss. (INIS)

9902 CORRELATION BETWEEN THE RELATIVE QUANTITY OF SOME NUCLEOTIDE PROTEINS IN DNA OF AN ORGANISM AND THE RADIOSENSITIVITY OF THE ORGANISM. Kritskii, G. A.; Aleksandrov, S. V. (Inst. of Biochemistry, Moscow). Dokl. Akad. Nauk SSSR; 212: No. 4, 1011-1014(Oct 1973). (In Russian).

A paper chromatographic study was made of the pyrimidine nucleotide proteins in DNA in the blood system of five mammels: guinea pigs, cattle, mice, rats, and rabbits. A statistically reliable correlation was detected between the relative quantity of some nucleotide proteins in the DNA of the organism and its radiosensitivity. A comparison was made with available literature data on the basic constituents of the DNA and the radiosensitivity of the organism. It was shown that a parallelism exists between the changes of these indicators. On the basis of the data available it was hypothesized that there is a causal relation between the characteristics of the block structure of the DNA and the radiosensitivity of the organism. (tr-auth)

9903 RADIATION-INDUCED CHANGES IN ESTABLISHED TUMOR IMMUNITY. Vaage, J.; Doroshow, J. H.; DuBois, T. T. (Massachusetts General Hospital, Boston). Cancer Res.; 34: 129-137(Jan 1974).

The effect of radiation therapy on tumor growth and on specific immune resistance to tumor growth was investigated in mice actively sensitized to a syngeneic sarcoma. While radiation was therapeutic for tumor growth in the radiated field, it was also found that extensive-field radiation, but not limited-field radiation, could facilitate the growth of tumors in unirradiated parts of the animal. The facilitation was greatest with radiation soon after the time of tumor implantation. (auth)

9904 CANINE CYCLIC NEUTROPENIA: A STEM CELL DEFECT. Weiden, P. L.; Robinett, B.; Graham, T. C.; Adamson, J.; Storb, R. (Univ. of Washington, Seattle). J. Clin. Invest.; 53: 950-953(Mar 1974).

Two normal collie dogs were given 1,200 R total-body irradiation followed by successful marrow grafts from their grey collie

littermates with cyclic hematopoiesis. During observation periods of 97 and 41 days after grafting, both previously normal recipients showed regular cyclic fluctuations of their granulocyte and reticulocyte counts similar to those observed in their donors. These findings suggest that canine cyclic neutropenia is due to a defect in the marrow stem cell. (auth)

9905 ANALYSIS OF CELL KINETICS DURING ULTRAVIOLET LIGHT-INDUCED EPIDERMAL CARCINOGENESIS IN HAIRLESS MICE. Chopra, D. P.; Forbes, P. D. (Temple Univ., Philadelphia). Cancer Res.; 34: 454-457(Mar 1974).

Proliferation kinetics at various stages of ultraviolet light-induced squamous cell carcinoma in hairless mice were studied by a double-labeling method. In irradiated mice, the growth fraction, as determined by continuous labeling with thymidine-^{3}H, was 100% in normal-appearing and hyperplastic epidermis and in lesions of squamous cell carcinoma. The growth fraction in control unirradiated mice was also 100%. The duration of T_c and S decreased progressively with induction and progression of the tumor. For normal-appearing epidermis of irradiated mice and epidermis of control mice, T_c and S were approximately 95 and 6.2 h, respectively. With the induction of hyperplasia, T_c and S were reduced to 43.75 and 4.45 h, respectively, while even lower values were obtained for squamous cell carcinoma where T_c = 16 h and S = 3.05 h. The labeling index in normal epidermis was 6.75% and increased progressively in hyperplastic epidermis (10.17%) and squamous cell carcinoma (18.98%). These results indicate that ultraviolet light-induced epidermal tumor production in hairless mice is associated with a progressive shortening of the cell cycle. (auth)

9906 EFFECT OF RADIATION ON METABOLISM OF SELECTED MINERALS IN CATTLE. Sasser, L. B.; Wade, L. Jr.; Bell, M. C. (UT-AEC Agricultural Research Lab., Oak Ridge, TN). J. Anim. Sci.; 38: No. 1, 178-185(Jan 1974).

Zinc, Cu, Ca, Mg, and Fe contents of plasma and/or erythrocytes of 184 kg-steers were studied following exposure of the steers to either (1) whole-body gamma irradiation, (2) beta irradiation of the gastrointestinal tract, (3) beta irradiation of the skin, and (4) all combinations of the above. Gastrointestinal (GI) irradiation reduced plasma Zn concentrations 1, 2, and 3 weeks after irradiation, but no detectable change occurred in the erythrocyte concentration of stable Zn. The uptake of ^{65}Zn by erythrocytes from control steers averaged about 5%; whereas the uptakes of the GI- and skin-irradiated steers exceeded 10%. Hypoferremia and hypercupremia accompanied the injury and infection produced by GI and skin irradiation. The decline of plasma Ca and Mg levels following GI irradiation appeared to be the result of radiation induced anorexia, as control animals with a restricted feed intake had a similar reduction in plasma Ca and Mg. (auth)

9907 MORPHOLOGICAL ASPECTS OF MYELOFIBROSIS, OBSERVED IN RATS FOLLOWING SUBLETHAL WHOLE-BODY IRRADIATION AND SUBSEQUENT ALLOGENEIC BONE MARROW CELL TRANSFUSION. Stodtmeister, R.; Fliedner, T. M. (Univ., Ulm, Ger.). Folia Haematol. (Leipzig); 100: No. 1/2, 23-50(1973).

The bone marrow histology of 34 rats, which were detected to demonstrate myelofibrosis among a total of 516 rats after whole-body irradiation and subsequent bone marrow cell transfusion, were analyzed to gain insight into the possible histogenetic factors determining the occurrence of fibrosis in the marrow, about hemopoietic regeneration in such cases of experimental myelofibrosis and about the implications of these cases for the understanding of myelofibrosis in man. Myelofibrosis was observed at intervals from 4 to 110 days after whole-body irradiation and marrow cell transfusion. The late onset type occurred in an apparently regenerated bone marrow, i.e. three or more weeks after irradiation. The early onset type of myelofibrosis developed during the first three weeks after irradiation. The very early onset type comprises a few cases in which hemopoietic regeneration was restricted to the presence of as yet undifferentiated lymphocytelike and early myeloid precursor cells. For the pathogenesis of myelofibrosis in all three types, the acute destruction of the regenerated or regenerating immature lymphocytelike myeloid (as shown by a positive NASDCl reaction) as well as more mature cells appeared to be an essential step in the initiation of the fibrotic process. This cell destruction was associated neither with obvious alterations of the vascular architecture, nor with edema or hemorrhage per se. In association with and subsequent to the destruction of actively proliferating (high frequency of mitotic figures) lymphocytelike myeloid cells, there is an appearance of fibroblasts and fibrocytes that finally take over the marrow in part or completely and eventually form a scar. Although no proof can be provided, there is a striking similarity in the histological appearance of these experimental cases of myclofibrosis and those in human pathology that Lennert has described as of an "immunological type". It is tempting to suggest that the experimental cases developed as a consequence of irradiation and allogeneic marrow cell transfusion and are an expression of an immunological reaction between host and grafted cells. (auth)

9908 CHARACTERISTICS OF REGENERATION OF RADIATION-INJURED PERIPHERAL NERVES FOLLOWING HOMOTRANSPLANTATION OF BONE MARROW. Yarosh, A. A.; Martynyuk, P. G. (Kiev Medical Inst.). Vrach. Delo; 9: 119-121(Sep 1973). (In Russian).

The effect was studied of transplantation of homologous bone marrow on the regeneration of peripheral nerves in combined radiation injury. Experiments were conducted on 217 rabbits (85 were donors, 132 were irradiated). The irradiated rabbits were given intraosseously bone marrow taken from the donors. It was found that the processes of regeneration in the lesioned nerve trunks took a more favorable course in the rabbits receiving homotransplantations of bone marrow. The effect was particularly good when bone marrow transplantation was initiated during the first three days following the radiation injury. (auth)

9909 INTRANEURONAL LIPID DROPLETS IN RADIATED NERVOUS TISSUE. de Estable-Puig, R. F.; Estable-Puig, J. F. (Laval Univ., Quebec). Virchows Arch.; 14: 117-125(28 Nov 1973).

Inclusions were found in the mitral cells of olfactory bulbs of proton-irradiated rats. They exhibited the fine structural features currently ascribed to lipid droplets. They were observed in the cytoplasm of perikaria and dendrites. The inclusions were tentatively interpreted as a structural manifestation of cell response to sublethal injury. This neuronal condition occurs occasionally under a variety of circumstances, but is seldom reported, and in fact, this might very well be the first electron microscopic illustration of fatty change in nerve cells. (auth)

9910 CELLS INVOLVED IN CELL-MEDIATED AND TRANSPLANTATION IMMUNITY IN THE RABBIT. VI. The Dissociation Between Cell-Mediated and Humoral Immunity of Particulate Antigens. Haasz, R.; Algom, D.; Richter, M. (McGill Univ., Montreal). Pathol. Microbiol.; 40: 15-29(1974).

It was demonstrated that, in the rabbit, there is a distinct dissociation between the cells activated in the induction of the humoral and delayed hypersensitivity states of immunity. This was best proved by the fact that 800 rad whole-body irradiation, which results in death or inactivation of the antigen-reactive cells involved in humoral immunity, did not abrogate the capacity of the rabbit to be sensitized to give delayed-type hypersensitivity skin reactions. It is concluded that these two types of immunity result from the activation of two different cell pathways. (auth)

9911 CHROMOSOME ABERRATION PERSISTANCE IN SWINE LEUKOCYTES FOLLOWING EXPOSURE TO FISSION NEUTRONS. Mailhes, J. B.; McFee, A. F. (Univ. of Tennessee, Oak Ridge). Contract AT(40-1)-GEN-242. Mutat. Res.; 23: No. 1, 79-86(Apr 1974).

Chromosome aberration rates in swine lymphocytes decreased rapidly within the first 24 h postirradiation. This initial loss coincided with a decrease in lymphocyte number and continued until lymphocyte numbers began to recover at 7 days after irradiation. Subsequent losses were less dramatic, and numbers of acentric fragments reached preirradiation levels by 56 days postexposure; rings and dicentrics persisted throughout the 84-day study. Mathematical models describe the predicted aberration yield as a function of time after irradiation. The disappearance rate of aberrant lymphocytes after irradiation suggests that aberration persistance kinetics should be considered when using lymphocyte aberrations as biologic dosimeters. (auth)

9912 EFFECTS OF RADIATION ON ^{75}Se AFFINITY OF TUMOR CELLS. J Nagy, E.; Nordman, E. (Magyar Tudomanyos Akademia, Budapest). Magy. Radiol.; 26: No. 2, 99-103(Apr 1974). (In Hungarian).

Under "in vitro" and "in vivo" conditions, the change of the selenic affinity of the tumor cells occurring under radiation effect was examined. In a tumorous animal, after irradiation and on the basis of the behavior of the sodium selenite it seems that the protein metabolism of the tumor cell may be influenced with considerably smaller dose than it has been supposed as yet. (auth)

9913 EXCESS LATE SUBCUTANEOUS FIBROSIS AFTER IRRADIATION OF PIG SKIN, CONSEQUENT UPON THE APPLICATION OF THE NSD FORMULA. Berry, R. J.; Wiernik, G.; Patterson, T. J. S.; Hopewell, J. W. (Churchill Hospital, Oxford). Brit. J. Radiol.; 47: No. 557, 277-281(May 1974).

The development of subcutaneous fibrosis after x irradiation in courses of 1, 6, or 30 fractions was studied quantitatively in the domestic pig. The NSD formula failed to predict the correct

variation in dose for changes in the number of fractions so as to produce comparable levels of connective tissue damage even over the clinically used range from 6f./18d. to 30f./39d.; the error in the prediction may amount to an excess dose of circa 30%. The slope of the iso-effect curve between 6 and 30 fractions was 0.46, compared with the combined fractionation and time factors of 0.33 in the NSD formula. The degree of late fibrosis did not correlate with the severity of the early skin reaction. It is suggested that the NSD formula is not suitable for use when planning new treatment schedules in which the number of dose fractions is reduced. (auth)

9914 NSD FORMULA. Berry, R. J.; Patterson, T. J. S.; Wiernik, G.; Hopewell, J. W. (Churchill Hospital, Oxford). Brit. J. Radiol.; 47: No. 557, 294(May 1974).

Brief answer is made to criticisms of a previous paper (Berry, R., Br. J. Radiol., V. 47 (557) p 293 (May 1974), and Ellis, F. Ibid, p 294). It is stated that contrary to criticisms, the authors' measurements on excess late subcutaneous fibrosis after irradiation of pig skin indicate that it is unwise to continue to apply the NSD formula in clinical use. Particular reference is made to correct doses, RBE, and the dangers of comparing effects in growing animal tissues and those of adult humans. (UK)

9915 NSD FORMULA. Ellis, F. (Milwaukee County General Hospital, WI). Brit. J. Radiol.; 47: No. 557, 293-294 (May 1974).

Comments are made on a paper on Excess Late Subcutaneous Fibrosis after Irradiation of Pig Skin, Consequent upon Application of the NSD formula (Berry, R., Br. J. Radiol., V. 47 (557) p 293 (May 1974)). Attention is drawn to the value of the regression coefficient for the isoeffect line, the importance of allowing for RBE, and the dangers of comparing growing pig and adult human skin. The significance of the exact nature of cutaneous and subcutaneous reactions is discussed, together with the distinction between primary and secondary cell-killing effects. It is pointed out that the time taken to reach the tolerance dose of the endothelial cells could alter the effect on epithelial cells. It is concluded that the NSD concept requires further clinical testing, but can be of use currently. (UK)

9916 PROTECTION AGAINST SECONDARY SYNDROME BY FACILITATING IMMUNE SERA. Voisin, J. E.; Kinsky, R. G.; Voisin, G. A. (INSERM, Paris). Ann. Immunol.(Paris); 124: 75-85(Feb 1973).

C57Ks anti-A/Jax immune sera, known for their facilitating-enhancing properties, were injected into lethally irradiated A/Jax mice restored with C57Ks bone marrow cells. This passive facilitation procedure resulted in a significant protection against the secondary syndrome induced by the allogeneic cells. The intensity of this protection, however, was not impressive and could not be increased by several experimental modifications and additions: varying the doses of immune serum; grafting A/Jax thymus to the recipient; mixing irradiated A/Jax cells with the immune serum (to form immune complexes); and pre-incubating C57Ks marrow cells with C57Ks anti-A serum before injection. This supports the concept that GVH is only one of the factors involved in the more complex secondary disease. Treatment of the prospective C57Ks cell donors by C57Ks anti-A serum resulted in a protection of the irradiated-allorestored recipients, thus suggesting a "central" action for the protective antibodies. (auth)

9917 ULTRASTRUCTURAL STUDY OF SYMPATHETIC GANGLION SATELLITE CELLS IN THE RAT. I. Normal and X-Ray Irradiated Satellite Cells. Chang, P. L.; Taylor, J. J.; Wozniak, W.; Young, P. A. (St. Louis Univ.). J. Neural Transm.; 34: 215-234(1973).

The ultrastructure of normal and irradiated satellite cells of the rat superior cervical ganglia was studied. Each neuron is closely and completely invested by satellite cell cytoplasm. The satellite cell cytoplasm usually contains a number of mitochondria, granular endoplasmic reticulum, Golgi apparatus, lysosome-like bodies, filaments, microtubules, lipid droplets, centriole, and cilia. The satellite cell also encloses presynaptic nerve endings, and other nerve fibers. X-ray irradiation produces several changes in the satellite cells. These include: increased nuclear density; marked local widening of the perinuclear space; dilation of granular endoplasmic reticulum and loss of attached ribosomes; swelling of mitochondria with disorganization of mitochondrial cristae and loss of matrix; increase in the number of vacuoles; and increase in the number, size, and contents of lysosome-like bodies. (auth)

9918 CHANGE IN THE BINDING OF ACRIDINE ORANGE BY NUCLEAR DEOXYRIBONUCLEOPROTEINS OF LYMPHOID SERIES CELLS DURING MATURATION. Manteifel, V. M.; Vinogradova, N. G.; Zelenin, A. V. (Inst. of Molecular Biology, Moscow). Izv. Akad. Nauk SSSR, Ser. Biol.; 5: 740-743(1973). (In Russian).

Acridine orange (AO) binding capacity of the rat lymph node lymphocytes in the different stages of the maturation was investigated. It has been shown that the DNP of undifferentiated cells of the lymphatic series possess a high affinity to AO. This affinity decreases in the course of the maturation of the lymphatic cells. The obtained data are in agreement with the results of the previous experiments of the cytochemical study of nuclear histones, in which histone stainability of the lymphocytes was shown to increase with the cell maturation. The x-ray damage of the lymphocytes has been found to result in the increase of DNP capacity to bind AO. The obtained data are interpreted as a result of the changes in the interaction between DNA and histones. (auth)

9919 TESTICULAR CHANGES IN MICE AFTER TREATMENT WITH MITOMYCIN C. Leonard, A.; Gilliavod, N. (CEN/SCK, Mol, Belg.). Toxicology; 1: 217-233(1973).

Male mice from the BALB/c strain, 11 to 13 weeks old, received an i.p. injection of 5 mg/kg of mitomycin C dissolved in 0.5 ml distilled water. Following injection, four mice were killed on days 7, 14, 21, 28, 35, 50, and 100. Testicular damage was estimated by analyzing the incidence of the germinal cell types (spermatogonia, spermatocytes, spermatids, and spermatozoa) in the median cross sections of tubules at the various periods post-injection. Comparison between the present results and estimation, made by the same technique, of the histological damages induced in mouse testes by ionizing radiations shows that injection of 5 mg/kg of mitomycin C has the same effect as exposure to about 1000 R of x irradiation. (auth)

9920 SEROLOGIC STUDIES ON LEUKEMIC CELLS IN A NEW STRAIN OF INDIAN LABORATORY MOUSE. Nadkarni, J.; Nadkarni, J. S.; Ranadive, K. J. (Tata Memorial Centre, Bombay). Indian J. Exp. Biol.; 11: No. 6, 503-506(Nov 1973).

Lymphatic leukemia occurred spontaneously with high frequency in ICRC strain of mice, inbred by brother-sister mating since 1957. Antigenic studies on these leukemic cells revealed cross-reactivity with Gross virus. Membrane immunofluorescence and cytotoxicity tests with Gross, Moloney, and Kaplan radiation-induced tumor cells against immune sera from ICRC animals and ICRC leukemic cells against anti-Gross, Moloney, Graffi, and Kaplan sera revealed cross-reactivity with Gross virus alone. The specificity of this reaction was demonstrated with absorption tests. Lymphatic leukemia occurring in these ICRC mice was likely due to Gross or Gross-type virus. (auth)

9921 INVESTIGATIONS ON THE EFFECT OF X RAYS ON NEUROSECRETION IN THE RAT. Dubis, K. (Inst. of Biomorphology, Krakow). Folia Biol. (Krakow); 22: No. 1, 3-23(1974).

The effect of x irradiation of the head region of the rats with a single large dose of x rays on the hypothalamo-neurohypophyseal neurosecretory system was studied. Observations were carried out on the 7th, 14th, and 21st days post irradiation. Post irradiation the neurosecretory activity of neurocytes of nucleus supraopticus and nucleus paraventricularis decreases and with an increase in the dose of x rays the changes become greater. It was also observed that the cell nuclei of neurocytes of nucleus supraopticus react more strongly to the x irradiation, that is they decrease more than do cell nuclei of neurocytes in nucleus paraventricularis. The existence of differences in the neurosecretory activity of nucleus supraopticus and nucleus paraventricularis between males and females was also determined. In females the more reactive nucleus of the hypothalamus proved to be nucleus supraopticus whereas in males it was nucleus paraventricularis. The activity of x rays on neurosecretory centres of the hypothalamus is to a strong degree specific, since in other parts of the encephalon, e.g. nucleus amygdaloideus medialis, the reaction to x irradiation is weaker. (auth)

9922 FORMATION OF COMPLEXES BETWEEN DNA AND RNA-POLYMERASE FROM THE NUCLEI OF ALBINO RAT LIVER. Likhodid, V. S.; Shantir, V. I.; Pashkevich, I. F. (Inst. of Medical Radiology, Kharkov). Dopov. Akad. Nauk Ukr. RSR, Ser. B; No. 3, 269-271(Mar 1974). (In Ukrainian).

Formation of complexes between ^{14}C-RNA-polymerase A and DNA isolated 48 and 120 h after irradiation of the animals in a dose of 800 R was studied. The quantity of bound RNA-polymerase depends on the state of DNA, the more defects in the secondary structure of DNA 48 and 120 h, the more places for the enzyme binding. (auth)

9923 PROSPECT OF COMPUTER IMPLEMENTATION OF RADIOTHERAPY. Glicksman, A. S. (City Univ., New York); Nickson, J. J. Int. J. Bio-Med. Comput.; 2: No. 1, 39-47(Jan 1971).

An automated treatment facility is described that would be capable of taking the information from a planning-simulator,

utilizing an instant isodose readout system, and transferring this information to the computer memory, which activates a megavoltage therapy unit. All parameters of this therapy unit can be automatically controlled except the insertion of the proper wedge-compensator apparatus. A permanent record of the treatment technique and dosage would be available in the patient's file, which could be updated after each treatment. Monitoring of the automated treatment from a central control room that would be in continuous visio-audio communication with the therapy room is envisaged. The radiotherapist can be assured that the patient would receive exactly what has been planned. The opportunity presented by such a system is one of freedom to concentrate on those aspects of patient care that humans, and only humans, can do, relegating the machine to the repetitive tasks that it can do better. (auth)

9924 LUCHEVOE PORAZHENIE MLEKOPITAYUSHCHIKH I STATISTICHESKOE MODELIROVANIE. (Radiation Injuries to Mammals and Statistical Modelling). Akoev, I. G.; Maksimov, G. K.; Malyshev, V. M. Moscow; Atomizdat (1972). 96p.

The possibility of using modern statistical methods of modeling for analyzing and correlating clinical and experimental data on radiation damage in mammals is considered. The use of special mathematical distributions in studying the relation between the clinical appearance of damage to the organism and the extent of damage to systems indicated new methods of modeling for probable prognosis of isolated, modified, and combined damage with the possibility of extrapolation to the human and grouping of individuals according to the characteristics of the damage. Predicted extent and time parameters of the damage and of recovery are compared with clinical and experimental data. (tr-auth)

9925 PROTECTION OF MOUSE SPERMATOCYTES AT DIFFERENT RADIATION DOSES WITH INDENE COMPOUNDS. Plotnikava, S. I.; Mosse, I. B.; Freimanis, Ya. F. (Inst. of Genetics and Cytology, Minsk). Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk; No. 3, 78-82(1974). (In Ukrainian).

The effect of the indene compounds F-14 and F-57 on the chromosome aberration yield induced in spermatocytes of line C_3H mice by x irradiation at doses of 100, 200, 300, 400, 500, 600, 650, and 700 R at dose rates of 20 and 26 R/min was studied. The mice were 2 to 2.5 months old. LD_{50} = 75 mg/kg for F-14 and 500 mg/kg for F-57. The controls were irradiated at the same doses. Thirty minutes before the irradiation the test animals received an intraperitoneal injection of the indene compounds at a concentration for F-14 of $\frac{1}{3}$ LD_{50} and for F-57 of $\frac{1}{10}$ LD_{50}. The test frequency of the reciprocal translocations in the spermatocytes at the stage of diakinesis of metaphase is one meiosis. It was noted that the protective effect of the indene compounds is maintained at almost all radiation doses. These data confirm the earlier proposed hypotheses on the mechanism of the effect of indene compounds. (tr-auth)

9926 EARLY AUTOANTIBODY FORMATION IN LETHALLY IRRADIATED OR DRUG-TREATED H-2-COMPATIBLE RECIPIENTS OF PRE-AUTOIMMUNE NZB BONE MARROW OR FETAL LIVER CELLS. Morton, J. I.; Siegel, B. V. (Univ. of Oregon, Portland). Transplantation, 17: No. 6, 624-626(Jun 1974).

Experiments demonstrated that antinuclear autoantibody formation could be transplanted into H-2-histocompatible DBA/2 and BALB/c strain mice using marrow cells from 20-day-old NZB mice or liver cells from 18-day NZB fetuses. Positive Coombs' tests were also detected in 4 of 12 recipients of NZB fetal liver. There was a definite requirement for eradication of host hemopoiesis before the grafted NZB cells could convert the recipients to autoimmunity. This autoimmune conversion occurred rapidly within 1 week after grafting to drug-treated animals and in 3 to 4 weeks in the case of lethally irradiated recipients. Thus, although the chimeric status of the graft recipients was not established, it seems likely that early ANA formation in recipients which have little or no residual hemopoiesis of their own was a consequence of proliferation of the engrafted NZB marrow or fetal liver cells. These observations lend further credence to the concept that the information permitting or promoting autoantibody formation is an inherent property of the NZB hemopoietic stem cell. (auth)

9927 RADIOACTIVE GOLD IN THE TREATMENT OF OCULAR SQUAMOUS CELL CARCINOMA OF CATTLE. Banks, W. C.; England, R. B. (Texas A and M Univ., College Station). J. Amer. Vet. Med. Ass.; 163: No. 7, 745-748(1 Oct 1973).

Bovine ocular squamous cell carcinomas were treated successfully with implantations of radioactive isotopes. Due to their location, some ocular carcinomas have not been easily treated by previous means of implantation; however, implantation of ^{198}Au seeds is a satisfactory method of treating such carcinomas. Limiting factors to the use of ^{198}Au seeds are cost and proximity to a source for activating the isotope, the latter being particularly important because of the isotope's short half-life. (auth)

9928 REPEATED EXPOSURE TO X-RADIATION AND RADIATION-INDUCED TASTE AVERSION. Chernovetz, M. E. O. Athens, GA; Univ. of Georgia (1973). 69p. University Microfilms Order No. 74-4766.

Thesis (Ph. D.).

The effect of repeated presentation of x-radiation on radiation-induced saccharin aversion was studied. Forty-five experimentally naive male albino rats were assigned nine each to one of five conditions (0, 1, 2, 4, or 8 exposures to 50 rads of x-radiation). Eight trials were given at five day intervals with the subjects receiving sham or x-radiation exposure. Throughout the study, the subjects had access to two bottles of tap water for two hours each day. On the day of trial eight the subjects were given 0.1% saccharin flavored water instead of tap water. Ninety minutes following removal of the bottles the final x-radiation or sham trial was given. The day following trial eight the subjects were given access to one bottle of tap water and one bottle of saccharin flavored water during the two hour drinking period. Preference testing continued for five days and then four days of presentation of water alone preceded a final preference test on day ten. Fifteen rats were treated identically to the above subjects but received a single exposure to 100, 200, or 360 R of x-radiation following ingestion of saccharin flavored water. Recovery from x-radiation was assessed by measuring body weight and fluid intake throughout the experiment. Results indicated that previous experience with x-radiation significantly reduces the magnitude of saccharin aversion following a single presentation of saccharin flavored water prior to a final x-radiation exposure. The magnitude of the aversion was dependent on the number of previous exposures. The group receiving two exposures to x-radiation developed less aversion than the group receiving one exposure. Groups receiving four, eight, or zero exposures developed less aversion than groups receiving one or two exposures. The results also indicated that the groups receiving larger single doses of x-radiation developed a greater aversion than subjects receiving a single exposure to 50 R. (Diss. Abstr. Int., B)

9929 EFFECT OF PRETREATMENT WITH DRIED THYROID GLAND UPON WHITE BLOOD CELL CHANGES IN SUBLETHALLY X-IRRADIATED MICE. Pospisil, M.; Netikova, J. (Inst. of Biophysics, Brno). Folia Biol. (Prague); 20: No. 2, 138-144(1974).

Changes in white blood cell counts were followed in mice fed for three weeks with dried thyroid gland preparation in amounts of 0.6 g per 100 g of Larsen diet (free access to food) and irradiated on the day of termination of the feeding period with a sublethal exposure dose of 450R. Granulocyte and lymphocyte counts were determined immediately before radiation exposure and at various post-irradiation time intervals both in unchallenged mice and in mice injected with endotoxin. Thyroid gland administration induced a decrease in granulopoietic activity, apparently due to a competition between erythrocytic and granulocytic cell population production in bone marrow. Post-irradiation recovery of granulopoiesis was stimulated by thyroid gland pretreatment. Indirect indicators of suprarenal cortex activity (weight changes of adrenal glands and thymus, fall in lymphocyte counts after endotoxin) suggest an increased stress reactivity of animals pretreated with dried thyroid gland. (auth)

9930 STIMULATION OF ENDOGENOUS SPLEEN COLONY FORMATION BY B- AND T-LYMPHOCYTE MITOGENS. Wlodarski, K.; Jakobisiak, M.; Kossakowska, A.; Zelechowska, M. (Medical School, Warsaw). Folia Biol. (Prague); 20: No. 2, 133-137

Plant lectins PHA and Con A, specific T-lymphocyte mitogens and PPD, a B-lymphocyte mitogen, exhibit stimulating activity on endogenous spleen colony formation in sublethally irradiated mice. The stimulatory effect was obtained irrespective of whether the mitogens were administered before or after irradiation of animals. It is suggested that a mediator or factors displaying colony-stimulating activity, released from lymphocytes in response to various mitogens, may be responsible for the increase in the number of spleen colonies. (auth)

Invertebrates

Refer also to abstracts 9722, 9763, 12111, 12116, 12143, and 12145.

9931 (CNAEM-98) EFFECT OF CYSTEAMINE ON THE SYNTHESIS OF NUCLEIC ACIDS (DNA AND m-RNA) AND PROTEINS OF DIFFERENT CELL TYPES. Bolukbasi, R. (Cekmece Nuclear Research Center, Istanbul (Turkey)). 1972. 29p. INIS. Thesis.

The effect of cysteamine on the synthesis of DNA in the chromosomes of Drosophila melanogaster larvae and on DNA, m-RNA,

and protein synthesis of rat embryonic and L-strain cells in tissue culture were investigated by the use of histological, autoradiographic, and tissue culture technics. Cysteamine, by depressing the synthesis of the above mentioned molecules at a considerable rate, affected the metabolism of the diverse cell types significantly. The species specific of cysteamine was once more observed in the experiments. As a conclusion, it is recommended that the safest use of cysteamine in therapy would only be of a topical application. (INIS)

9932 POPULATION APPROACH TO THE STUDY OF REPAIR OF GENETIC RADIATION DAMAGE IN MATURE SPERMATOZOA OF DROSOPHILA MELANOGASTER. Sankaranarayanan, K. (Leiden State Univ.). Mutat. Res.; 22: No. 3, 287-293(Mar 1974).

The results presented show that (i) in the two populations, irradiation of the males generation after generation does not strongly decrease egg-hatchability below the level observed, say, after one generation of irradiation and these levels are similar in the two populations; (ii) contrasting post-treatments to males does not seem to affect egg-hatchability in any differential way; (iii) there appears to be no consistent post-radiation modifying effects of nitrogen and oxygen on recessive lethals induced in the second chromosome and consequently, the populations, in spite of the different post treatments, do not diverge from one another and (iv) the pattern of accumulation of recessive lethals in the two populations is consistent with reasonable assumptions about the mutation rate and the intensity of selection acting against lethals in the heterozygous condition. It seems that population methods are perhaps not the best to study repair of genetic radiation damage (as measured by autosomal recessive lethals) in Drosophila spermatozoa. (ERB)

9933 INHIBITING EFFECT OF CAFFEINE ON THE MATERNAL REPAIR OF RADIATION-INDUCED CHROMOSOME BREAKS IN DROSOPHILA. Mendelson, D.; Sobels, F. H. (Leiden Univ.). Mutat. Res.; 26: No. 2, 123-128(Apr 1974).

From symposium on caffeine as an environmental mutagen and the problem of synergistic effects; Uppsala, Sweden (5 Jun 1973).

Drosophila females were treated with caffeine and mated to males that had been exposed to 2000 R x irradiation; only mature spermatozoa were sampled. The frequencies of radiation-induced dominant lethals, sex-chromosome losses, and II-III translocations in the paternal genome were determined. Treatment of the females with caffeine led to an increase in the frequency of dominant lethals and sex-chromosome loss and to a decrease in the frequency of translocations. If it is assumed that dominant lethals and sex-chromosome loss arise mainly from open, non-restituted breaks, and that translocations are the result of misrepaired breaks, the present findings suggest that caffeine acts by partially inhibiting repair processes acting in the oocytes, processes that are required for the repair or misrepair of chromosome breaks induced in the spermatozoa. (auth)

9934 DEVELOPMENT IN GENETIC MOSAICS OF ARISTAPEDIA. A Homoeotic Mutant of Drosophila Melanogaster. Postlethwait, J. H.; Girton, J. R. (Univ. of Oregon, Eugene). Genetics; 76: No. 4, 767-774(Apr 1974).

Development of the homoeotic mutation, aristapedia (ss^a), was investigated by means of genetic mosaics. The wild-type alleles of aristapedia and the bristle markers yellow, singed, and forked were removed from cells at different times in development by x-ray induced somatic crossing-over. The phenotype of the resulting clones was examined in order to ascertain whether it was leg or antenna. The y sn f; ss^a clones showed a leg phenotype if induced before the mid-third instar, but showed an antennal phenotype if induced after this time. Late non-expression of ss^a may be due either to an influence of surrounding ss^+ tissues on the small ss^a clones, or to a persistence of the effect of ss^+ for one or two cell generations after is is removed from a cell line. (auth)

9935 FROM DDT TO ^{60}Co. De Murtas, I. D. (CNEN, Casaccia, Italy). Sapere; No. 724, vp(May 1970). (RT/BIO-(72)55).

DDT and its powerful derivatives started a new era in pest control. The indiscriminate use of these pesticides has recently given rise to a series of events which are seriously affecting the biological equilibrium. The sterile insect technique using a ^{60}Co γ source offers new possibilities in the field of pest control and the success of the preliminary experiments show the value of the potential use of it. (IT)

9936 DISPERSAL OF CERATITIS CAPITATA WIED. ON PROCIDA ISLAND. II. Movement Studies. De Murtas, I. D. (CNEN, Casaccia, Italy); Cirio, U.; Enkerlin, D. EPPO Bull.; No. 6, 69-76(1972). (RT/BIO-(72)75).

Results of a study to relate the flight capability of Ceratitis to irradiation doses and to feeding showed that 9 Krads γ radiation is a suitable dose for control programs and that feeding the newly emerged flies seems to affect their distribution over greater distances. (auth)

9937 DISPERSAL OF CERATITIS CAPITATA WIED. ON PROCIDA ISLAND. I. Distribution of Sterilized Mediterranean Fruit-Fly on Procida and Its Relation to Irradiation Doses and Feeding. De Murtas, I. D. (CNEN, Casaccia, Italy); Cirio, U.; Enkerlin, D. EPPO Bull.; No. 6, 63-68(1972). (RT/BIO-(72)72).

Experiments were undertaken to collect information on the dispersal of Ceratitis, bred and γ irradiated in the laboratory, when liberated in an ecologically heterogeneous area such as the Procida Island. Adults, from irradiated pupae, made recognizable through a special dye applied to the pupae, were released when 2 to 3 days old at a southern tip of Procida (Solchiaro) characterized by low precipitation and intensive insolation. The flies rapidly left the arid Solchiaro district but their spread became very limited as soon as they reached zones where suitable host-plants were numerous and the general picture of the flights indicated certain preferential directions. It was concluded that for practical control purposes, sterile flies should be released also in places where host-plants were absent or rare since they would rapidly move to more favorable places of their own choice. On the other hand, movement in regions with a dense network of host-plants was found to be slow. In such regions the release points should therefore not be more than 100 m apart. (auth)

9938 UV IRRADIATION OF POLAR CELLS OF DROSOPHILA MELANOGASTER EMBRYOS. V. A Study of the Meiotic Recombination in Females With Chromosomes of Different Structure. Prudhommeau, C.; Proust, J. (Paris Univ., Orsay, France). Mutat. Res.; 23: No. 1, 63-66(Apr 1974).

Polar cells of female embryos heterozygous for the genetic markers st in ri were uv-irradiated. The effect of uv irradiation on the meiotic recombination within the st-ri segment was analyzed. In individuals that contained this chromosome segment in its normal position, uv increased the rate of meiotic recombination. If this segment were separated from the centromeric heterochromatin and translocated on the left arm of chromosome II, uv did not influence meiotic recombination to a significant extent. On the other hand, in non-irradiated controls the individuals containing the translocated segment showed an increased rate of recombination within the segment compared with individuals having the segment in its normal position. These results can be explained by Suzuki's hypothesis according to which a heterocatalytic activity of heterochromatin shows an antagonism to meiotic recombination. UV seems to interfere with this antagonism indirectly via induction of physiological damage. (auth)

9939 INFLUENCE OF WATER RADIOLYSIS PRODUCTS ON THE MORTALITY OF THE PROTOZOA SPIROSTOMUM AMBIGUUM. Balcerzak, C. (Akademia Medyczna, Lodz, Poland). Ann. Acad. Med. Lodzensis; 12: 7-18(1971). (In Polish).

The aim of this paper has been to show which of the products of the water radiolysis cause the mortality of the protozoa Spirostomum ambiguum. The irradiation of a water molecule leads to the formation of free radicals OH and atoms H, which as a result of secondary reactions give molecular hydrogen and hydrogen peroxide. The molecular hydrogen—as it was shown—was not lethal to the protozoa. As for hydrogen peroxide, its concentration in the water irradiated with the lethal dose of 240000 rads and containing the protozoa amounted to $(1.03 \pm 0.03)\ 10^{-4}$. The same concentration of the hydrogen peroxide did not prove to be toxic to the nonirradiated protozoa, which perish only in the solutions of strength of over $2.5 \cdot 10^{-4}$ M/1. The OH radicals were found to influence the mortality of the protozoa in a marked way: the increase in the radical OH concentration in the system involved an increased mortality of the protozoa, its decrease entailed a decreased mortality. No visible changes of the mortality of the irradiated animals could be observed as a result of the increased H concentration in the system. (auth)

9940 MATERNAL EFFECTS ON X-RAY-INDUCED SEX CHROMOSOME LOSS IN MATURE SPERM OF DROSOPHILA MELANOGASTER: A STORAGE EFFECT IN MATURE OOCYTES. Buerki, K.; Wuergler, F. E. (Swiss Federal Inst. of Tech., Zurich). Arch. Genet.; 46: 53-61(1973).

Earlier work showed that the recoverable rate of x-ray-induced sex chromosome loss in mature sperm of Drosophila melanogaster depends on the genotype of the females used for the test cross. The maternal effects result in loss rates differing by factors up to 4.5. Recent experiments with Hikone-R females indicate that the rate also depends on the physiological state of the mature oocytes present in the test females. With oocytes stored for a few days in virgin females the rate of recoverable paternal sex chromosome loss is about twice the rate recorded with non-stored, freshly produced oocytes. To avoid inconclusive results in future experiments, aimed to the analysis of the genetic con-

trol of the maternal effects, the influence of storage of mature oocytes has to be controlled carefully. (auth)

9941 RADIATION SENSITIVITIES OF THREE SPECIES OF FIDDLER CRABS (UCA PUGILATOR, U PUGNAX, AND U MINAX). Engel, D. W. (National Marine Fisheries Service, Beaufort, NC). Chesapeake Sci.; 14: No. 4, 289-291(1973).

The radiation sensitivities of five estuarine decapod crustacea were compared: three species of fiddler crabs, Uca pugilator, U. pugnax, U. minax; the blue crab, Callinectes sapidus, and the grass shrimp, Palaemonetes pugio. Temperature and salinity (20C and 30 $^{0}/_{00}$) and radiation dose rate (310 rad/min) were the same for all species. The 40-day LD-50 values for the fiddler crabs (U. pugilator, 9,800 rad; U. pugnax, 16,500 rad; and U. minax, 13,500 rad) fell between those of the blue crab, 42,000 rad, and grass shrimp, 215 rad. Possible physiological and ecological explanations for the differences in sensitivity are discussed. (auth)

9942 X-RAY INDUCED MITOTIC RECOMBINATION IN DROSOPHILA MELANOGASTER. III. Dose Dependence of the Pairing Component. Haendle, J. (Univ. Munich). Mol. Gen. Genet.; 128: No. 3, 233-239(Feb 1974).

The three effects of x irradiation, which have been found in earlier experiments could be interpreted to be two breakage-fusion mechanisms and induced chromosome pairing. It was assumed that the induced chromosome pairing is a function of the x-ray dose and that it must be present so that the break type that is due only to spectrum II can result in a twin spot. To investigate this assumption, larvae were first irradiated with various doses of spectrum I in order to induce various degrees of chromosome pairing. Immediately afterwards they were irradiated with a constant dose of spectrum II in order to induce a constant number of chromosome breaks. The three dose effect curves show the frequencies of twin spots induced by three different doses of spectrum II and their dependence on chromosome pairing. They also show that maximal chromosome pairing is not always induced by the same dose of spectrum I, but by lower doses for higher numbers of breaks of break type II. This means that although chromosome pairing is necessary for break type II to recombine, the chromosome pairing is itself influenced by the induced breaks. The possibility that this third x ray effect should not be interpreted as induced chromosome pairing but on the basis of repair and recombination enzymes was broached. (auth)

Radionuclide Effects (Internal Source)

Refer also to abstract 9793.

Man

Refer also to abstracts 9499, 9535, 9795, 9802, 10015, 10080, 10081, 10084, and 11698.

9943 (AEC-tr-7457, pp 248-253) POSSIBILITY OF EXTRAPOLATING BIOLOGICAL EFFECTS OF ^{90}Sr FROM ANIMALS TO MAN. Rasin, I. M.; Sarapul'tsev, I. A.; Panteleev, L. I. 1972. Translated from pp 162-166 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

An effort was made to substantiate the possibility of extrapolating the metabolic patterns of ^{90}Sr from animals to man, on the basis of analogy of calcium metabolism in different growing mammals. Data are presented on the biological half-life of ^{90}Sr in man, cattle, sheep, goats, and swine. It was concluded that it is possible to extrapolate the metabolism of osteotrophic radionuclides from experimental mammals to man using the parameters of mineral metabolism and skeletal formation as a function of time. (CH)

9944 (AERE-R-7728) NEUTRON CAPTURE PROBABILITY FOR SODIUM ACTIVATION IN MAN PHANTOMS. Delafield, H. J. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Apr 1974. 15p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

In nuclear accident dosimetry, the neutron capture probability in man is required to estimate the dose from the induced sodium activity in the body. This activity results mainly from the capture of thermal neutrons by the $^{23}Na(n,\gamma)^{24}Na$ reaction. Existing experimental data has been carefully examined, and a representative value of 0.27 is derived for the capture probability of fast neutrons for a realistic man phantom. By contrast, the thermal capture probability was measured to be 0.19, using a broad beam of thermal neutrons from the graphite column of a nuclear reactor. The sodium activity in the man phantom was found to depend on orientation and could vary by as much as 40%. (auth)

9945 ESTIMATES OF MICROCURIE-DAYS RESIDENCE, BONE DOSE EQUIVALENT, AND $(MPC)_w$ FOR THORIUM-232 IN MAN USING A MAMMILLARY MODEL. Bernard, S. R. (Oak Ridge National Lab., TN). Bull. Math. Biol.; 35: 129-147(1973).

A four-compartment mammillary model for the distribution and excretion of thorium and its daughter radium is studied and applied to the problem of estimating the radiation dose to organs and tissues of man for the case of a single intake of ^{232}Th. The long-lived daughter ^{228}Ra (~6 y) grows in with time and gives birth to the other short-lived daughters (<0.4 day) which irradiate those tissues in the vicinity of their point of production. Some data on ^{228}Th and its daughter ^{224}Ra are available on dogs from which a model is derived and tested. Then, from some single-intake data (Th and Ra) on man, parameters for the model are estimated and estimates of residence times of the ^{232}Th daughters in man are made. Also, the 50-year radiation dose (dose equivalent) to bone from a single intake of ^{232}Th is estimated. (auth)

9946 PERCHLORATE TEST IN HYPERTHYROID PATIENTS TREATED WITH RADIOACTIVE IODINE. Kieffer, J.; Medeiros Neto, G. A.; Rueda, R.; Pieroni, R. R.; Neto, A. C.; Campusano, L. L.; Ulhoa Cintra, A. B. (Instituto de Energia Atomica, Sao Paulo, Brazil). New Engl. J. Med.; 273: 1326-1327(Dec 1965).

Perchlorate discharge test (PDT) was performed in 48 patients with hyperthyroidism previously treated with radioactive iodine (^{131}I) and at different stages regarding thyroid function. It was noted that all euthyroid patients (22) treated with RAI and followed up to 30 months had a negative PDT; the same was observed for patients with hyperthyroidism (5) but still on the hyperthyroid range. However hyperthyroid patients in remission (4) and euthyroid patients (14) recently treated (1 to 3 months) had a positive PDT. A positive test was also found in 3 patients who were hypothyroid 14 to 20 months after RAI therapy. An enzymatic damage to the peroxidase system induced by the radiation, and partially reversible with time, was postulated in order to explain the outcome of the PDT in these patients. (auth)

9947 NEW UNIFYING THEORY FOR THE INITIATION OF AGEING MECHANISMS AND PROCESSES. Griffiths, T. R. (Univ. of Leeds, Eng.). Mech. Ageing Develop.; 2: No. 4-5, 295-307(1973).

This theory is based on the special properties that can be evinced by the deuterium atoms occurring naturally within the molecules of an organism. The stereospecific and other properties peculiar to bonds involving deuterons, as distinct from protons, are summarized and examined in the light of ageing theories, and in particular a possible explanation for the initiation of the error proteins in Orgel's theory is given. The principle that an organism will, on chemical considerations, retain some of the deuterium present in drinking water and foodstuffs is described and considered in the light of the limited experimental evidence, and the possible contribution of deuterium enrichment to ageing processes is examined. The deleterious effects of administering high levels of heavy water to organisms is outlined and the parallels to ageing effects drawn. Finally some experimental results are discussed and some of the future experiments required delineated. (auth)

9948 EFFECT OF RADIOACTIVE RADON (Rn-222) LIBERATED FROM WATER ON BLOOD RADIOACTIVITY AND BLOOD SUPPLY OF TISSUES. Halawa, B. Pol. Tyg. Lek.; 28: 1638-1640(15 Oct 1973). (In Polish).

The blood and tissue blood flow of patients was investigated after a radioactive bath and inhaling radon collecting above the bath tub containing radioactive water. During the time of bathing the increase of blood radioactivity and flow through the tissues was 68% due to inhaling of radon collecting above the water. Twenty minutes inhalation above the bath tub with radioactive water causes an increase of blood and tissue radioactivity similar to that from 15 minute bathing in radioactive water. Such inhalations are better tolerated than bathing, especially by older people. (auth)

9949 HEAVY WATER NYSTAGMUS AND EFFECTS OF ALCOHOL. Money, K. E.; Myles, W. S. (Defence and Civil Inst. of Environmental Medicine, Downsview, Ont.). Nature (London); 247: No. 5440, 404-405(8 Feb 1974).

A study was made of the eye movements of a number of human subjects after drinking 100 to 200 g of heavy water. All the subjects developed positional nystagmus, which occurred 30 min. after drinking and lasted a further 5 to 6 hr. The direction of the nystagmus was opposite to that produced by alcohol. Sensations of body rotation, dizzyness, and nausea were also experienced. The degree of nausea with heavy water varied inversely with the subject's experience with alcohol ingestion; heavy drinkers did not experience nausea, whereas abstainers suffered severely. Heavy water nystagmus was also experienced by cats. When both alcohol and heavy water were ingested by cats nystagmus did not occur—the opposite directions of the movements cancelling out. Apparent mechanisms are discussed, based on density of ear fluids. (UK)

9950 EXPOSURE OF PATIENTS TO IONIZING RADIATION CONNECTED WITH THE USE OF RADIONUCLIDES IN MEDICAL DIAGNOSTICS. Baltrukiewicz, Z. Pol. Przegl. Radiol. Med. Nukl.; 38: No. 1, 77-83(1974). (In Polish).

Data are presented on the activity of radionuclides sold to diagnostic laboratories, and the exposure of patients examined by isotope methods is estimated, and the quantity of methods themselves are discussed. A rise was demonstrated in the number of patients examined and the range of radioisotope investigations has been extended. The doses of radiation absorbed by various critical organs and gonads and genetic doses in certain types of investigations are mentioned. (auth)

Animals

Refer also to abstracts 9860–9862, 9878, 10034, and 10139.

9951 (AEC-tr-7457, pp 43-49) CHANGES IN TOTAL QUANTITY OF MARROW CELLS AND THEIR MITOTIC INDEX IN RATS, FOLLOWING BRIEF AND PROLONGED γ IRRADIATION. Koznova, L. B.; Zaytseva, R. N.; Tikhomirova, L. K. 1972. Translated from pp 28-33 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Preliminary studies of dose-effect function for rats in the case of intensive and prolonged irradiations revealed that the dose level for 50 percent survival constituted 620 R for brief irradiation at a dose rate of 584 R/min, and 1,511 R for 4-day irradiation at the rate of 0.26 R/min. Experiments were conducted to investigate some indices of bone marrow hemopoiesis as related to irradiation at different dose levels. Indices reported include the total quantity of bone marrow cells per rat femur and the mitotic index of marrow cells. The rats were sacrificed by decapitation. The animals in the two series of experiments were examined before irradiation, then 20 hours later, and 2 to 21 days after termination of both prolonged and brief γ irradiations. At each interval an average of 5 to 7 animals were examined. For each series of experiments 10 control rats were sacrificed. The experimental data obtained were processed using modern biometric methods. (CH)

9952 (AEC-tr-7457, pp 50-55) VIABILITY OF RATS FOLLOWING EXPOSURE TO VARIABLE DAILY DOSES OF γ RADIATION. Malakhovskii, V. N.; Oreshkin, I. G.; Khoruzhenko, A. F.; Rezontov, V. A. 1972. Translated from pp 34-37 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Data are presented on the cumulative effect of variable doses of γ irradiation on the survival of rats. Irradiations involving a variable daily dose, with the contribution of each daily fraction to the total biological effect determined by its level plus a certain coefficient of effectiveness which equaled the coefficient of effectiveness of multiple irradiation with the same daily fraction for the entire course of irradiation. (CH)

9953 (AEC-tr-7457, pp 123-126) BIOLOGICAL EFFECTS OF DIFFERENT DOSES OF ^{131}I IN MAMMALS. Kalistratova, V. S. 1972. Translated from pp 82-84 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Radioactive iodine (^{131}I) administered at doses of 0.2 to 4 μCi/gram to rats caused development of clinical signs of damage that could be described as signs of athyroidism and hypothyroidism. Administration of this isotope at a dosage of 0.06 μCi/gram elicited damage the symptomotology of which is consistent with hyperthyroidism. Iodine-131 at a dosage of 0.016 μCi/gram did not elicit a biological effect at the early stage of observation. (auth)

9954 (AEC-tr-7457, pp 184-188) RELATIVE BIOLOGICAL EFFECTIVENESS OF TRITIUM OXIDE. Maskalev, Yu. I.; Zhuravlev, V. F.; Kalistratova, V. S.; Istomina, A. G.; Petrovich, I. K.; Kazbekova, D. A. 1972. Translated from pp 123-126 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The RBE of tritium β as compared to ^{137}Cs γ rays for rats ranged from 1.61 to 2:17 according to leukocyte reaction, and 1.44 to 2.20 according to lymphocyte reaction on the 1st, 3rd, 7th, and 14th days following administration. On the 7th day, the RBE of tritium oxide was 2.09 according to neutrophil reaction, and on the 14th day 1.94 according to the erythrocyte reaction. On the 1st, 3rd, 7th, and 14th days, the RBE of tritium oxide ranged from 1.61 to 2.09 according to change in thymus weight, and on the 3rd and 7th days it ranged from 1.74 to 1.89, according to change in spleen weight. On the 1st and 3rd days, according to the change in blood sugar, the RBE of tritium oxide ranged from 1.4 to 1.9. (auth)

9955 (AEC-tr-7457, pp 189-194) EFFECT OF TRITIUM OXIDE ON HEMOPOIETIC TISSUE IN THE ACUTE PERIOD OF RADIATION DAMAGE OF MICE. Shumova, T. E.; Strashenko, S. I.; Zhukova, I. V.; Zhuravlev, V. F.; Strel'tsova, V. N. 1972. Translated from pp 123-126 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Tritium oxide is a uniform β-emitter and the range of β particles of tritium in tissue is 0.5 micron which is considerably smaller than mammalian cells. With regard to physicochemical properties, tritium oxide is close to water, it spreads relatively uniformly in the aqueous phase, and most of it is rapidly eliminated from the organism. For mice, the elimination half-life is 1.9 days. After 20 days, the concentration of tritium oxide activity in body fluids constitutes only 0.1% of initial activity. The dynamics of elimination of tritium oxide indicates that it is bound not only with water but also with organic structures of the organism. Because of metabolism with hydrogen, which is contained in all organic molecules, a small share of tritium may be incorporated in vital structures of tissue cells, including DNA. Results are reported from a comprehensive study of the biological effects of tritium on hemopoiesis, as well as on the genetic structures of hemopoietic cells of mice given tritium oxide intraperitoneally, at the rate of 0.3 μCi per gram of body weight. They were followed up for one month; the mice were decapitated on the 1st, 3rd, 7th, 14th, 21st, and 30th days after administration of tritium. Hemopoiesis was assessed on the basis of analysis of peripheral blood, analysis of myelograms, morphological findings on bone marrow, spleen, thymus, and lymph nodes. In addition, analysis was made of chromosomes in metaphase plates of bone marrow cells prepared by the Ford method. To evaluate the degree of genetic lesions, demonstration and determination was made of type of chromosomal aberrations; the number of chromosomes in the metaphase was counted; cells with chromosomal anomalies were counted. (auth)

9956 (AEC-tr-7457, pp 195-206) CHANGES IN CARBOHYDRATE METABOLISM OF DOGS FOLLOWING ADMINISTRATION OF TRITIUM OXIDE. Poluboyarinova, Z. I. 1972. Translated from pp 130-138 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Studies revealed that dogs given single doses of tritium oxide at the rate of 0.08 to 0.15 μCi/gram developed lasting hypoglycemia and occasionally marked glucosuria. Biochemical and physiological mechanisms are postulated. After administration of 0.15 μCi/gram of tritium oxide, the dogs developed acute radiation sickness. Two of the three dogs expired after 14 and 30 days, one survived, presenting the chronic form of illness, and has now been under observation for more than 4 years. The mean tissue dose in the dog organism constituted 186 to 270 rads. The two dogs that received 0.08 μCi/gram developed subacute radiation sickness, which then turned into the chronic form. The mean tissue dose constituted 90 to 104 rads. These dogs survived for 20 and 44 months. (auth)

9957 (AEC-tr-7457, pp 207-210) AUTOIMMUNE REACTIONS OF PREGNANT RATS TO RADIOISOTOPES. Kuz'mina, T. D.; Lyaginskaya, A. M.; Sinitsyna, S. N. 1972. Translated from pp 138-140 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The significance of the autoimmune process in pregnant rats given 0.4 and 0.04 μCi/gram ^{131}I or 0.3 μCi/gram tritium oxide during the early stages of pregnancy was investigated. Presence and extent of autosensitization were assessed by the quantity of hepatic and fetal antibodies circulating in blood. Results showed that administration of radioisotopes at different stages of pregnancy elicited appearance of autoantibodies to both liver antigen and fetal antigen. It was concluded that the development of autoimmune processes probably causes pathological changes in the offspring. (CH)

9958 (AEC-tr-7457, pp 219-224) ACCUMULATION AND DISTRIBUTION OF ^{137}Cs IN SWINE FOLLOWING PROLONGED ADMINISTRATION. Nikitina, Z. A.; Panchenko, I. Ya.; Burov, N. I. 1972. Translated from pp 145-148 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Data are presented on accumulation and distribution of ^{137}Cs in swine and its transfer to pork as a function of age and duration of intake. (auth)

9959 (AEC-tr-7457, pp 237-242) TISSUE DOSES IN DIFFERENT RAT ORGANS AND TISSUES FOLLOWING CHRONIC ADMINISTRATION OF ^{90}Sr. Sarapul'tsev, I. A.; Goloshchapova, Zh. A.; Shvedov, V. L.; Tuzhilkova, T. N. 1972. Translated from pp 155-159 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Beta dose levels and absorbed doses in the skeletal system, as well as some vital organs, such as the liver, kidneys, spleen, adrenals, hypophysis, and heart of rats were determined following chronic intake of ^{90}Sr with food. Doses in different organs and tissues of rats of different ages were determined using an esti-

mating method, quantitative autoradiography, and radiometric analysis of tissue samples. The animals were given ^{90}Sr with their food for their entire life (with milk during the lactation period) at concentrations of 0.0005 to 5.0 μCi per day per rat. Dose measurements were made at birth and at various ages up to 12 months. (auth)

9960 (AEC-tr-7457, pp 254-265) PATHOLOGICAL ANATOMY OF RADIATION LESIONS DUE TO CHRONIC ADMINISTRATION OF ^{90}Sr. Tuzhilkova, T. N.; Shvedov, V. L.; Andreeva, L. P.; Semenova, V. P.; Goloshchapova, Zh. A.; Boytsova, V. P. 1972. Translated from pp 166-176 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Initial changes in osteogenesis with chronic intake of ^{90}Sr were manifested in rats with accumulation of at least 2,000 rads in the skeletal system. The maximum absorbed dose in the skeleton not associated with a decrease in quantity of nuclear cells in bone marrow corresponded to 1,000 rads. The minimal blastomogenic dosage was 4,000 and maximal was 16,000 rads. Survival time with chronic intake of ^{90}Sr began to diminish with absorbed doses in excess of 4,000 rads. (auth)

9961 (AEC-tr-7457, pp 266-270) BONE REGENERATION IN RAT OFFSPRING IN THE EARLY POSTNATAL PERIOD FOLLOWING CHRONIC EXPOSURE TO ^{90}Sr. Semenova, V. P.; Tuzhilkova, T. N.; Shvedov, V. L. 1972. Translated from pp 176-179 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Rats exposed to ^{90}Sr as fetuses and infants via chronic uptake by pregnant or lactating mothers were examined. Restoration of bone following fracture in the offspring of rats exposed to ^{90}Sr (in doses of 1 and 2 μCi) was inhibited at all stages of callus formation. The changes in the regenerative process in bones of rat offspring were probably due to the condition of the maternal bone system. (CH)

9962 (AEC-tr-7457, pp 271-277) BIOLOGICAL EFFECTS OF ^{90}Sr AND DOSE REDISTRIBUTION WITH ADMINISTRATION OF SORBENT-TYPE PROTECTIVE AGENTS. Malkin, P. M.; Dubrovina, Z. V. 1972. Translated from pp 179-183 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Administration of calcium alginate, a sorbent-type protective agent, altered the correlation between ^{90}Sr doses absorbed in the skeleton and GI tract of rats. Administration altered the dose-effect curve in the range of high levels of intake of ^{90}Sr (more than 5 μCi/gram, once). There was a complex correlation between the coefficient of effectiveness (K_{eff}) of the agent and its biological effectiveness, due to dose redistribution in the organism under the influence of the sorbent. Nomograms were plotted, which permit estimation of the required effectiveness of protection as related to a specific level of intake of ^{90}Sr, according to criteria of its biological action. (auth)

9963 (AEC-tr-7457, pp 322-329) TOXICOLOGY OF ^{237}Np. Buldakov, L. A. 1972. Translated from pp 214-220 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

A study was made of the toxic effects of oxalate and nitrate solutions of ^{237}Np. Experiments were made on 770 male Wistar rats, with daily intraperitoneal administration at doses of 0.006 to 3.04 μCi/kg. With chronic intraperitoneal administration, the $LD_{50/30}$ was 3.07 μCi/kg, and $LD_{50/180}$ was 0.298 μCi/kg. The differences between neptunium oxalate and nitrate LD_{50} at different times were not significant. The shorter mean survival, decreased body weight, degree of anemia, thrombopenia, leukopenia, and reticulocytosis progressed linearly, with increase in daily administered doses of neptunium oxalate and nitrate. (auth)

9964 (AEC-tr-7457, pp 330-341) TISSUE DISTRIBUTION AND BIOLOGICAL EFFECTS OF ^{237}Np. Moskalev, Yu. I.; Rudnitskaya, E. N.; Zalikin, G. A.; Petrovich, I. K. 1972. Translated from pp 220-229 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

One day after intravenous injection of ^{237}Np in rats the following levels (percentages) were demonstrable: 54.2 in the liver, 21.5 in the skeletal system, 11.7 in muscles, 4.6 in the spleen, and 3.55 in the kidneys. Elimination of ^{237}Np from the rat liver can be described by a two-exponent function: elimination of 37.5% is referable to T_b = 4 days, and 62.5% to T_b = 52 days. There is virtually no elimination of ^{237}Np from the skeletal system. With administration of ^{237}Np nitrate, the chemical toxicity of this compound moves to the fore at the early stages and the radiation factor at the later stages. Acute ^{237}Np damage is characterized by development of toxic dystrophy of the liver and necrotic nephrosis. At the later stages, the entire range of pathological processes inherent to the long-term consequences of radiation were observed. Osteosarcoma develops with relatively low levels of irradiation (~48 rads). In toxic doses, ^{237}Np has virtually no effect on the peripheral blood as a radiation factor. (auth)

9965 (AEC-tr-7457, pp 342-351) MORPHOLOGICAL CHANGES AND MICRODISTRIBUTION OF ^{237}Np IN THE RAT LUNG FOLLOWING INTRATRACHEAL ADMINISTRATION. Levdik, T. I.; Lemberg, V. K.; Lyubchanskii, E. R. 1972. Translated from pp 229-236 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The biological effectiveness of ^{237}Np, in the case of intratracheal administration of different salts thereof, is determined by the physicochemical form and quantity of compound administered. At a dosage of 5 μCi/kg, intratracheally administered ^{237}Np presented acute chemical toxicity in rats. The oxalate form was considerably more toxic (36% death with the first 7 days) than neptunium nitrate (5.7% death in the first 7 days). Microdistribution of ^{237}Np in the rat lung on the first day after intratracheal administration in the form of nitrate was essentially diffuse; after administration of ^{237}Np oxalate, it was distributed primarily in the form of aggregates. After 7 to 360 days, in both instances there was concentration of aspirated particles of neptunium along the bronchi and vessels, mainly in the region of the root. The histological changes in the lungs of ^{237}Np-treated animals were relatively of the same type in all groups. At the early stages, the typical finding was necrotic inflammation with marked injury to the vascular walls of the respiratory tract. After 3 to 12 months, pneumosclerosis develops at the sites of accumulation of the element, with signs of squamous-cell metaplasia of the bronchial and alveolar epithelium, which leads to malignant growth. (auth)

9966 (AEC-tr-7457, pp 352-358) TOXIC EFFECT OF ^{237}Np ON RAT HEPATOCYTES. Sobolev, S. G.; Lemberg, V. K. 1972. Translated from pp 236-241 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

After intravenous administration of ^{237}Np nitrate in a dosage of 0.75 μCi per rat, there was a certain sequence of changes in ultrastructure of hepatocytes. Fifteen minutes after administration, there was uniform widening of the endoplasmic reticulum which disappeared by the 3rd hour. In some rats, destruction of the lysosome membranes was observed and focal degeneration of cytoplasm appeared after 6 hours. After 12 and more hours, marked changes in the structure of the transport system of the cell were observed, including widening of cisternae of the endoplasmic reticulum, fragmentation of its membranes, and scaling of ribosomes. After 24 hours, changes in mitochondrial structures and nuclei were observed. The first signs of normalization of cellular organelles were found 6 hours after administration of the isotope. (auth)

9967 (AEC-tr-7457, pp 381-390) ULTRASTRUCTURE OF THE ALVEOLAR-CAPILLARY BARRIER IN RATS FOLLOWING SINGLE INHALATION OF ^{239}Pu CITRATE. Aristov, V. P. 1972. Translated from pp 257-265 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

9968 (AEC-tr-7457, pp 391-397) MAXIMUM PERMISSIBLE ^{239}Pu LEVEL ACCORDING TO THE OSTEOSARCOMOGENIC EFFECT. Pesternikov, V. M. 1972. Translated from pp 265-270 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

A mathematical expression was obtained for the mean life expectancy of animals with osteosarcoma as function of mean absorbed dose rate in the skeletal system following ^{239}Pu uptake by mice, rats, and dogs. Estimated maximum ineffective absorbed dose rates in the skeletal system was 0.05 for mice, 0.012 for rats, and 0.002 rad/day for dogs. The estimated maximum ineffective plutonium level in the human organism constitutes 0.021 to 0.028 μCi, which is 1.5 to 2 times lower than the level approved by the International Commission on Radiological Protection as the maximum permissible level. (auth)

9969 (AEC-tr-7457, pp 398-406) RESPIRATORY INSUFFICIENCY AND COMPENSATION IN THE PRESENCE OF INJURY FROM ^{239}Pu INHALATION IN RATS. Kalmykova, Z. I. 1972. Translated from pp 270-276 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

9970 (AEC-tr-7457, pp 407-411) PATHOGENIC FACTORS RELATED TO LONG-TERM SEQUELAE OF INJURY DUE TO INHALATION OF ^{239}Pu. Koshurnikova, N. A.; Poplyko, M. G. 1972. Translated from pp 276-279 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Single inhalation of nitric oxide and chlorine by rats at doses that do not elicit early death lead to a higher incidence of pneumosclerosis and lung tumors, as compared to the control; inhalation of chlorine shortened mean rat survival. Simultaneous inhalation of ^{239}Pu and nitric oxides or chlorine shortened survival even

more, and intensified the sclerosogenic and blastomogenic action of this isotope. (auth)

9971 (AEC-tr-7457, pp 455-459) CHANGES IN THE HEMATOPOIETIC SYSTEM OF DOGS FOLLOWING DAMAGE DUE TO INHALATION OF ^{241}Am. Kudasheva, N. P. 1972. Translated from pp 312-315 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

9972 (AEC-tr-7457, pp 460-467) EFFECTS ON DOG ERYTHROCYTES OF INHALATION OF DIFFERENT DOSES OF ^{241}Am. Kalmykova, Z. I.; Karpova, V. N. 1972. Translated from pp 315-320 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

9973 (AEC-tr-7457, pp 468-474) CHANGES IN THE CARDIOVASCULAR SYSTEM OF DOGS AFTER INHALATION OF ^{241}Am. Kalmykova, Z. I.; Doshchenko, V. N. 1972. Translated from pp 320-324 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

9974 (AEC-tr-7457, pp 475-485) MICRODISTRIBUTION AND MORPHOLOGICAL CHANGES IN DOGS FOLLOWING UPTAKE OF ^{241}Am. Rudnitskaya, E. I. 1972. Translated from pp 324-331 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Isochnikov Radiatsii, Moscow, Meditsina, 1972.

Americium-241 chloride, administered in one intravenous injection to dogs at doses of 60, 30, 10, and 7.5 μCi/kg, caused 100% deaths in the interval of 9 to 31 days after the start of the experiment. The animals that died presented signs of acute radiation sickness. The immediate cause of death was bone marrow aplasia. With doses of 10 μCi/kg and less, the dogs develop foci of extramedullary hemopoiesis. One of the distinctions of microdistribution of this nuclide is early aggregation of particles in bone marrow and liver, which explains the great sensitivity of dogs to ^{241}Am. (auth)

9975 (AEC-tr-7457, pp 486-490) THYROID AND PARATHYROID INJURY FOLLOWING ^{241}Am UPTAKE. Rudnitskaya, E. I. 1972. Translated from pp 331-334 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

After intravenous administration of ^{241}Am chloride to rats at doses of 0.25 to 0.0025 μCi/gram, there was aggregation of particles in the thyroid cartilage, starting on the 3rd day. The agent was demonstrated by α autoradiography to be present in the thyroid and parathyroid in finely dispersed form at all examination times from the first to 200 days following administration. An increase in clear cells in thyroid tissue was observed starting on the 3rd day. Focal clear-cell hyperplasia was observed in the parathyroid. (auth)

9976 (AEC-tr-7457, pp 491-497) HISTOPATHOLOGY OF RAT TESTICLES INJURED BY ^{241}Am. Ovcharenko, E. P.; Lyaginskaya, A. M. 1972. Translated from pp 334-340 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Intravenous administration of 0.001 μCi/gram ^{241}Am led to changes in the germinal epithelium of the rat testicle after 6 months, but did not (throughout the observation period) arrest the process of spermatogenesis or elicit sterility. A dosage of 0.0005 μCi/gram ^{241}Am elicited negligible changes in the germinal epithelium after 6 to 7 months, but spermatogenesis did not stop. The typical distinction of testicular reaction to ^{241}Am was the appearance of changes in the tubules in the middle of the testicle, which was perhaps related to the distinctive microdistribution of ^{241}Am in the testicles. Investigations using histoautoradiographic methods revealed that a significant quantity of ^{241}Am absorbed in the testicle was in the intertubular connective tissue, and mainly along the periphery of the organ. The frequently encountered separation of seminiferous tubules was associated with appearance of typical folds. Histological analysis of the testicles made at different times up to 12 months after administration of ^{241}Am indicated that as time advanced development of pathological processes in the testicle progressed. Restoration of spermatogenesis was not observed in any of the groups. (auth)

9977 (AEC-tr-7457, pp 498-504) BLASTOMOGENIC EFFECT OF ^{241}Am. Nifatov, A. P.; Buldakov, L. A.; Filippov, L. G. 1972. Translated from pp 340-345 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Single intraperitoneal administration of a citrate complex of ^{241}Am to rats at doses of 1.16, 2.6, 6.5, and 11.9 μCi/kg shortened mean survival rates by 14, 22, 31, and 43%, respectively, as compared to control animals. Americium-241 caused development of osteosarcoma, kidney tumors, and increased the incidence of leukemia. The optimum osteosarcomogenic dosage of ^{241}Am was found to correspond to a skeletal radiation dose of 1,664 rads. The osteosarcomogenic effectiveness of ^{241}Am, after single intraperitoneal administration of a citrate complex of the isotope in doses of 1.16 to 11.9 μCi/kg was lower than that of ^{239}Pu. (auth)

9978 (ORNL-tr-2823) CHANGES IN STRUCTURE OF ANIMAL POPULATIONS (TERRESTRIAL AND SOIL INVERTEBRATES) DUE TO SOIL CONTAMINATION WITH ^{90}Sr. Krivolutskii, D. A.; Tikhomirova, A. L.; Turchaninova, V. A. Translated by Martha Gerrard from Pedobiologia; 12: 374-380(1972). 6 p. Dep. NTIS $4.00.

The abundances of soil invertebrates (some terrestrial insects and pests) on plots in a birch-pine forest experimentally contaminated with ^{90}Sr and in a control area were compared. The dynamics of population density during the warm period (from May till September) were analyzed. Some data about the accumulation of ^{90}Sr in different species of invertebrates and in birch litter and birch wood are given. On the contaminated plots of forest soil the general abundance of soil invertebrates was reduced more than twice, especially of Lumbricidae and Myriapoda. The greatest differences of abundances in experimental and control areas were observed after the period of propagation. (auth)

9979 (ORO-3728-7) MUTAGENIC EFFECT OF RADIONUCLIDES INCORPORATED INTO DNA OF DROSOPHILA MELANOGASTER. Progress Report, 1973-1974. Lee, W. R. (Louisiana State Univ., Baton Rouge (USA). Dept. of Zoology and Physiology). 1974. Contract AT(40-1)-3728. 9p. Dep. NTIS $4.00.

Progress is reported on studies of the mutagenic effects of tritium incorporated into DNA of Drosophila melanogaster. Methods for labeling Drosophila are discussed. (CH)

9980 RADIOBIOLOGY OF IRRADIATED LEUKOCYTES. VI. Respiratory Capacity, Proteolytic Activity, and the Level of Microelements. Turcu, G. (Institutul de Medicina Farmacie, Bucharest). Biophysik; 10: No. 4, 293-298(Dec 1973).

The paper continues a series of investigations regarding the determination of certain biochemical and biophysical parameters of the leukocytes taken from animals internally irradiated with ^{32}P. The parameters determined here are the respiratory capacity of PMN leukocytes from Wistar rats submitted to 1 and 2 μCi/g ^{32}P internal irradiations, the proteolytic power and the level of the microelements Zn, Cu, and Mn in the same cells and under identical irradiation conditions. The results show a diminished consumption of oxygen only during phagocytosis, a maximum diminution of the proteolytic activity of leukocytes at the 12th day of internal irradiation and a decreasing tendency of Zn, Cu, and Mn amounts in leukocytes of irradiated animals, most prominently appearing in the case of Mn. (auth)

9981 CLINICAL PICTURE AND RESULTS OF THE TREATMENT OF OCCUPATIONAL BRONCHOGENIC CANCER DUE TO IONIZING RADIATION. Suda, J.; Macholda, F.; Rehak, F. Stud. Pneumol. Phtiseol. Cech.; 32: No. 5-6, 259-262(June 1972). (In Czech).

An account is presented of observations made from 1962 to 1969 in a group of uranium miners suffering from bronchogenic cancer. Occupational carcinoma in uranium miners differs much from usual lung cancer as regards frequency and other characteristics. The duration of exposure to ionizing radiation was in 80% of the cases 5 to 15 years, and the mean age of patients 53.1 years. As regards the histological picture, the anaplastic (small-cell) type predominated over the pavement-cell type (58 against 26%). The course of the disease was in general very rapid; treatment and surgery had little effect. Only 5% of the patients survived 3 years after diagnosis. It was concluded that there are other specific factors besides ionizing radiation in Czechoslovak uranium mines that have a direct or indirect effect on the occurrence of lung cancer. (Occup. Saf. Health Abstr.)

9982 TRANSPLANTATION OF RADIATION-INDUCED CANINE MYELOMONOCYTIC LEUKEMIA. Shifrine, M.; Wolf, H. G.; Taylor, N. J.; Galligan, S. J.; Wilson, F. D.; Colgrove, G. S.; Bustad, L. K. (Univ. of California, Davis). Bibl. Haematol.; No. 39, 158-169(1973).

From fifth international conference on comparative leukemia research; Padua, Italy (1971).

Myelomonocytic leukemia induced by internal ^{90}Sr β radiation, was transplanted five times in beagle dogs via intrauterine fetal inoculation of malignant cells. The gross pathology of donor and recipient dogs is detailed. An outstanding feature in the recipients was the presence of solid chloromatous tumors. Cytogenetic evaluation of various tissues from all recipient dogs showed proliferation of donor cells. The derived cell line was pseudodiploid (2n = 78) and contained a very small unpaired acrocentric autosome, which is considered a marker for the malignant cell line. (auth)

9983 ACTION OF PARATHYROID HORMONE AND ^{45}Ca ON THE BONE TISSUE OF RATS. Dobroskok, A. I.; Krasnoshchekova, G. P.; Likhtarev, I. A.; Rokhlin, G. D. Byull. Eksp. Biol. Med.; 77: No. 4, 112-115(Apr 1974). (In Russian).

Experiments conducted on albino rats with the aid of quantitative treatment of roentgenograms demonstrated that a combined action of exogenous parathyroid hormone and ^{45}Ca led to a complicated bone reconstruction: thinning of the vertical layers of long bones with an increase in the extent of bone tissue mineralization. (auth)

Nuclide Kinetics and Toxicology

Refer also to abstracts 9793, 12113, and 12138.

9984 EFFECT OF pH ON THE KINETIC AND SPECTRAL PROPERTIES OF CROTALUS ADAMANTEUS PHOSPHOLIPASE A_2 IN H_2O AND D_2O. Wells, M. A. (Univ. of Arizona, Tucson). Biochemistry; 13: No. 11, 2265-2268(21 May 1974).

The activity of Crotalus adamanteus phospholipase A_2 is controlled by a group with a pK = 7.65 in H_2O and 8.40 in D_2O. Inhibition by H^+ is uncompetitive with respect to Ca^{2+} or substrate and appears to involve an effect on the interconversion of the central complexes. At high pH there is no deuterium isotope effect. Ca^{2+} causes a spectral perturbation of phospholipase A_2 which is pH dependent. In H_2O the pK of the perturbing group is 7.6 and in D_2O 8.3. The spectral perturbation caused by Ca^{2+} is the same in H_2O and D_2O. These results suggest that a charge-induced spectral perturbation of tryptophan is relieved at high pH. The close correlation between the effect of D_2O and pH on the enzymatic activity and the Ca^{2+}-induced spectral perturbations strongly suggests that the same residue in the protein is involved in both processes. (auth)

Man

Refer also to abstracts 9944, 9945, 9968, 10076, and 10135.

9985 (AEC-tr-7457, pp 243-247) PHYSICOCHEMICAL MODEL OF SELECTIVE BINDING OF CALCIUM AND STRONTIUM BY BLOOD SERUM. Korytnyi, V. S.; Panteleeva, A. P.; Puchkova, S. M. 1972. Translated from pp 159-162 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The maximum capacity of human blood serum was experimentally determined in vitro with reference to calcium and strontium ions, constituting 20 and 14 mgeq/liter, respectively. The passage of bivalent cations into protein-containing medium against an apparent concentration gradient and their exit constitute a process related to migration of other ions. The presence of K^+ and Na^+ ions in the aqueous phase increases significantly the exit of Ca^{2+} and Sr^{2+} from the protein phase. These facts are consistent with the hypothesis of ion exchange properties of protein media and are relevant to ^{90}Sr distribution and retention in man. (CH)

9986 (BNL-18802) HOW RADIOACTIVE ARE YOU? Hull, A. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1973. 21p. (CONF-740450-1). Dep. NTIS $4.25.

From 7th international water quality symposium; Washington, District of Columbia, USA (22 Apr 1974).

A basis for comparison of both benefit and risks in activities releasing radioactivity is discussed. The provision of an adequate supply of electrical energy has an obvious benefit to the population of the United States, as is evident from the comparison of gross national product and per capita electrical consumption for various nations. The health risk from the production of electricity using the heat from nuclear fission should be compared with the risks from the currently practicable alternative means of producing it from fossil fuels, as well as in the context of other generally accepted risks of everyday living. An average exposure of less than 0.0002 R/yr in the year 2000 from the overall releases of radioactivity to the environment from nuclear technology is projected. A design cut-off level, below which radiation risks from nuclear facility effluents are simply not worth further argument or expenditures is discussed and 0.017 R/yr proposed as such a design level. (CH)

9987 (CONF-740708-1) METABOLIC MODEL FOR COPPER FOR USE IN INTERNAL DOSE ESTIMATION. Bernard, S. R. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 3p. Dep. NTIS $4.00.

From symposium on dynamics studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974).

This model was used to estimate the μCi-days residences of ^{64}Cu. For the Cu-albumin compartments, the liver, ceruloplasmin, kidneys, red blood cells, and tissues, the following values were obtained: 0.113, 0.418, 0.0177, 0.0146, 0.0256, and 0.0577, respectively. Doses were estimated for total body (uniform concentration), liver, brain, and kidneys. To obtain the concentration in brain, after Cartwright and Wintrobe, it was assumed brain had six times the concentration in the tissues so if Q denotes μCi-days/kgm, then Q_B (the μCi-days in brain) = 6 Q_t (the μCi-days/kgm in tissue). Tissue and organ weights of Reference Man were used. (auth)

9988 (COO-1826-28) URANIUM MINER LUNG CANCER STUDY. Progress Report. Saccomanno, G. (Saint Mary's Hospital, Grand Junction, Colo. (USA). Dept. of Pathology). 22 Mar 1974. Contract AT(11-1)-1826. 15p. Dep. NTIS $4.00.

Progress is reported on an epidemiological study of the incidence of lung tumors in 385 uranium miners in relation to their cigarette smoking habits and exposure to radiation and other toxic inhalants present in uranium mine air. A tumor registry was established and data were collected on sputum cell changes in miners who have retired or quit cigarette smoking, or both. (CH)

9989 (INIS-mf-1033) ABSORPTION OF LEAD-210 AND POLONIUM-210 FROM THE GASTROINTESTINAL TRACT OF RAT AND MAN. Ramzaev, P. V.; Nizhnikov, A. I.; Litver, B. Ya.; Troitskaya, M. N.; Lisachenko, E. P.; Ibatullin, M. S.; Frmolseva-Makovskaya, A. P.; Korzun, V. N.; Shakalova, V. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1973. 8p. (In Russian). INIS.

Experiments were carried out on rats and in observations on people to determine the absorption of lead-210 and polonium-210 from the gastrointestinal tract. The absorption of lead-210 in rats over a period of more than 2 days was on the average 21 ± 1% while the absorption of polonium-210 varied from 1 to 11%. The absorption coefficient of lead-210 from in vivo measurements in 2, 90, and 200 days was 21, 24, and 25%. Tables are presented on the excretion and absorption of lead-210 and polonium-210 in people. The absorption of lead-210 does not depend substantially on its form during entry into the gastrointestinal tract. Polonium-210 entering the kidney and bone are absorbed a factor of 5 to 9 greater than accepted (6%) by the standard handbook MKRZ-59. (SJR)

9990 (INIS-mf-1039) POSSIBILITY OF USING HAIR ANALYSIS TO DETERMINE POLONIUM-210 IN THE BONE AND LIVER OF MAN. Antonova, A. V.; Shvydko, N. S.; Ramzaev, P. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1973. 7p. (In Russian). INIS.

The ^{210}Po contamination level in the hair, bone, and liver of man was studied to obtain parameters relating these values from the results. Polonium-210 concentrations in hair, bone, and liver are given as determined on 10 bodies and on inhabitants of Leningrad (men and women). Relationships were derived from the parameters that can be used to estimate in an approximate fashion the ^{210}Po dose to the bone and liver of man, if the concentration of this isotope in the hair is known. (SJR)

9991 (IRS-I-49) CALCULATION OF DOSE FACTORS (g) AFTER INHALATION OF RADIOACTIVE SUBSTANCES. Westphal, J. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F.R. Germany)). 1971. 21p. (In German). INIS.

Work presented enables the determination of an inhalation dose for important radionuclides on the basis of calculated dose factors which regard the metabolic behavior and biological data. The metabolic behavior of radioactive substances is comprehensively described according to their chemical properties. The calculated dose factors (g) for radiologically important nuclides represent a relation between the activity concentration after release of radioactive substances and the dose to be expected in single organs after inhalation. In a brief discussion, it has been pointed out that biological information and data can be taken even today from ICRP-2 and there are only a few modifications in ICRP for most of radionuclides. (GE)

9992 (RFP-1783) SUMMARY OF THE DISTRIBUTION OF PLUTONIUM IN THE TISSUES OF 12 OCCUPATIONALLY EXPOSED WORKERS. Lagerquist, C. R.; Hammond, S. E.; Bokowski, D. L.; Hylton, D. B. (Dow Chemical U.S.A., Golden, Colo., Rocky Flats Div.). 17 Sep 1971. Contract AT(29-1)-1106. 14p. (CONF-711013-2). Dep. NTIS $4.00.

From 17th annual bioassay and analytical chemistry meeting; Boulder, Colorado, USA (13 Oct 1971).

Tissues obtained during autopsy of 12 employees occupationally exposed to Pu were examined for Pu content and distribution. Tissues from two employees had less than detectable amounts of Pu. The Pu content of 10 employees was compared with that estimated from results of urine analyses during the period of employment. It appears that Pu body burdens calculated from urinalysis were

consistently on the high side. The only place where this system really failed was in measuring amounts in wounds or in lungs from inhalation of high-fired Pu oxide. The wound counter and body counter must be used to supplement results of urinalysis. The distribution of Pu concentrations indicates that the amount retained by the skeleton is less than that of the lungs, lymph nodes, and the liver. Techniques for analyzing these tissues have been improving with experience and in some cases the early results look questionable. Also, it was concluded that larger bone samples and larger samples of other tissues should be analyzed. (CH)

9993 PASSAGE OF CALCIUM AND STRONTIUM ACROSS THE INTESTINE IN MAN. Spencer, H.; Warren, J. M.; Kramer, L.; Samachson, J. (Veterans Administration, Hines, IL). Contract AT(11-1)-1231-68. Clin. Orthop.; No. 91, 225-234(1973).

From conference on cellular mechanisms for calcium transfer and homeostasis; Portsmouth, NH (13 Sep 1970).

Both the amount of stable calcium in the diet as well as the presence or absence of food in the intestine play a role in the passage of ^{47}Ca and ^{85}Sr from the intestinal lumen into the vascular space. On a high calcium intake the average Ca/Sr ratio of the intestinal absorption in man was 1.33. This is in contrast to the high $^{47}Ca/^{85}Sr$ ratio of the intestinal absorption of 2.6 on low calcium intake previously reported. Also, the Ca/Sr ratio of the intestinal absorption could be reduced to unity by administering the strontium isotope in the absence of food. Studies performed on the passage of calcium and strontium in the opposite direction, i.e., from the vascular space into the intestine, by administering tracer doses of ^{85}Sr and ^{47}Ca intravenously, have shown that the plasma levels of ^{85}Sr and ^{47}Ca were similar in the first 24 hours. The 12-day cumulative fecal excretion of ^{85}Sr was only slightly greater than of ^{47}Ca, indicating little discrimination against the passage of strontium from the vascular space into the intestine in man. The average $^{85}Sr/^{47}Ca$ discrimination ratio of the intestinal excretions was only 1.22. (auth)

9994 STUDIES ON THE INTESTINAL ^{47}Ca ABSORPTION IN HEALTHY SUBJECTS AND PATIENTS WITH CHRONIC RENAL FAILURE AND ON THE SIGNIFICANCE OF VITAMIN D_3 OR 25-HYDROXYCHOLECALCIFEROL TREATMENT FOR RENAL OSTEOPATHY. Hesch, R. D.; Gerlach, W.; Henning, H. V.; Emrich, D.; Scheler, F.; Kattermann, R. (Univ., Goettingen, Ger.). Deut. Med. Wochenschr.; 97: No. 45, 1735-1744(Nov 1972). (In German).

The absorption value in per cent of the dose per litre of plasma two hours after oral intake of 10 to 15 μCi ^{47}Ca, is a reliable measure. The carrier dose, in the author's experience, is optimal with 50 mg calcium. The test differentiates well the impairment of intestinal calcium absorption in groups of patients with different degrees of renal failure. Diminution of calcium absorption has been noted with creatinine values as low as 2 mg/100 ml, so that this abnormality is the earliest demonstrable one in renal failure. Treatment of dialyzed patients with vitamin D or 25-hydroxycholecalciferol can again normalize impaired absorption. The lower dose of 25-hydroxycholecalciferol, compared with vitamin D, proves clinically the abnormal metabolism of cholecalciferol (vitamin D_3) in renal failure. This treatment is, however, limited by progressive hyperparathyroidism and must, therefore, be used only under strict clinical control. The prophylactic treatment of abnormal calcium absorption with vitamin D or 25-hydroxycholecalciferol is indicated in view of the late complications in renal failure (dialyzed patients). The dose is 1,000 to 3,000 IU (0.025 to 0.075 mg) of vitamin D. (auth)

9995 RADIOAKTIVNYE VESHCHESTVA I KOZHA. (Metabolizm I Dezaktivatsiya). (Radioactive Substances and the Skin. (Metabolism and Decontamination)). Il'in, L. A. (ed.). Moscow; Atomizdat (1972). 304p.

Data on the metabolism of radioactive substances during their incidence on the skin and questions on the decontamination of the skin are systematized and generalized. The mechanisms of its radioactive contamination and the regularities of the percutaneous resorption of the radioisotopes are discussed. The theory of permeation, of the regularity of the internal distribution, and of exchange of radioactive isotopes is examined. The characteristics of the interaction of the radioisotopes with different biochemical components of the skin are considered. Irradiation considerations and calculation of the absorbed dose with consideration of the experimental models of distribution and exchange of radioisotopes in the skin are examined. The data on the regularities established have a great significance for study and development in the area of standardization and decontamination of the skin from radioactive materials. (tr-auth)

9996 ASSESSMENT AND MANAGEMENT OF A PLUTONIUM-CONTAMINATED WOUND CASE. Schofield, G. B.; Howells, H.; Ward, F.; Lynn, J. C.; Dolphin, G. W. (British Nuclear Fuels Ltd., Windscale, Eng.). Health Phys.; 26: No. 6, 541-554(Jun 1974).

A plutonium contaminated wound is described together with its management. Initially, 14.2 μCi of plutonium were present in the wound; this figure being reduced to about 1.8 μCi after two excisions. During the period of assessment, DTPA was administered and the effect of this is discussed. Urinary excretion data were obtained and quantitative monitoring of the lymphatic channels of the arm and the liver were attempted. Various methods of assessment of body content are discussed which indicate the amount of retained plutonium to lie between 0.1 and 1.5 μCi. Chromosome culture from blood lymphocytes was undertaken which indicated probable preferential irradiation of these cells. (auth)

9997 METHOD FOR STUDYING THE DISTRIBUTION AND PULMONARY CLEARANCE IN MAN AFTER THE ADMINISTRATION OF RADIOACTIVE AEROSOLS. Gongora, G. (Institut du Radium, Paris); Gongora, R.; Jammet, J.; Magdelenat, H.; Jammet, H.; Roy, M ; Drutel, P.; Castillon du Perron, M.; Verdier, F.; Parrot, R ; Boscus, M. J. Biol. Med. Nucl.; 8: No. 33, 19-27 (1973). (In French).

Pulmonary clearance is a topic of increasing current interest. The study of pulmonary clearance in man using radioactive aerosols as transfer agents is discussed. A short term study was made with 14 individuals using a colloidal ^{198}Au solution. A long term study was carried out with two individuals using a colloidal ^{59}Fe oxide solution; ^{51}Cr tagged microspherical particles are taking over for future long term studies. The techniques and methods exposed have also been used for the study of the distribution of radioactivity between the lungs, bronchia, and digestive system and also of the aerosol administration efficiency. Whole body γ ray spectrometry counting and a thoracic scanning device were used for the measurements. The results presented concern the efficiency and distribution. Those referring to the pulmonary retention will be given in a further publication. (FR)

9998 DISTRIBUTION OF NATURAL ^{14}C IN THE HUMAN BODY AND THE TISSUE DOSES DUE TO IT. Rublevskii, V. P. Gig. Sanit.; No. 3, 48-50(Mar 1974). (In Russian).

The concentrations of ^{14}C and the tissue doses produced by them will be different and the higher, the greater the contents of carbon in them. For the bone tissue the equivalent dose amounts to 9 mbar/yr; this tissue must be the critical organ for ^{14}C. The consumed dose for the gonads equals 0.65 mrad/yr. In order to assess equivalent dose for them it is necessary to take into account the action of ^{14}C on the body owing to its chemical transformation a nitrogen atom as the result of radioactive dissociation in the molecules of RNA and DNA. In this case the critical organ may become the gonads. (auth)

9999 URANIUM MINER BIOASSAY SYSTEMS: LEAD-210 IN WHISKERS. Savignac, N. F.; Schiager, K. J. (Univ. of Wyoming, Laramie). Health Phys.; 26: No. 6, 555-565(Jun 1974).

The relationship of a ^{210}Pb bioassay system utilizing whiskers and the effects of the residence time of uranium mine ventilation air is presented. Inhalations of ^{210}Pb and ^{222}Rn were considered initially to be of minimal effect on the correlations between ^{210}Pb in biological samples and exposures from short-lived radon daughters. However, dependent on the residence time of mine ventilation air, the short-lived daughters can contribute 6 to 75% of the total ^{210}Pb intake per working level month, ^{210}Pb in the ventilation air 0 to 94%, and ^{222}Rn 0 to 75%. Leakage of old mine air into the ventilation air streams increases the percentage of ^{210}Pb in the ventilation air at the expense of the other two sources. The percentage of ^{210}Pb atoms per working level month to ^{218}Po atoms per working level month is constant for ventilation air of less than approximately 15-min residence time and for ventilation conditions where a minimum of old mine air blends into the ventilation air streams. ^{210}Pb bioassay systems would overestimate the hazards associated with ^{218}Po atoms under other ventilation conditions. (auth)

Animals

Refer also to abstracts 9504, 9858, 9859, 10060, 12127, and 12137.

10000 (AEC-tr-7457, pp 86-94) QUANTITATIVE RELATION BETWEEN PHYSICOCHEMICAL PROPERTIES AND SOME PARAMETERS OF RADIOISOTOPE METABOLISM IN MAMMALS. Dubrovina, A. V.; Sokov, L. A. 1972. Translated from pp 59-64 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Data pertaining to parameters of metabolism of a large group of radioisotopes in mammals were analyzed in an effort to find some correlation between uptake and energy of cation hydration.

The data show that there is a correlation between the most diverse parameters characterizing radioisotope metabolism in the organism and hydration energy. For elements with comparable values of E, this function is close to linear. However, with regard to some parameters, for example, the coefficient of element concentration in the cellular phase, the value of the crystal ion radius is apparently greater than energy of hydration. Other parameters, for example level of absorption from the GI tract, deposition in liver, share of plasma protein-bound element in filtration and reabsorption in the kidneys, have a single line of regression for a large group of isotopes. When the elements are incorporated, however, in some tissular structures, for example muscles or bones, a strict linear dependence on E is noted only for a group of elements that is limited with regard to energy characteristics. Evidently, the presence of such linear dependence for some group of elements is indicative of the same mechanism of uptake. Analyzing the functions obtained, some inaccuracy was noted in estimating the relative energy of hydration (E). For some elements the estimated E is visibly distinct from the experimental and the valence of some elements in compounds with plasma proteins or tissular structures appears to be an extremely complicated matter. It is suggested that changes in the physicochemical state of some radioisotopes occur as a function of time following administration to mammals. (CH)

10001 (AEC-tr-7457, pp 104-107) NONUNIFORMITY OF DOSE DISTRIBUTION FROM RADIOACTIVE IODINE INCORPORATED IN THE THYROID. Terekhov, N. F.; Klassovskii, Yu. A.; Krasnokutskii, V. M. 1972. Translated from pp 70-72 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

When estimating β doses, it is usually considered that the range of β particles is somewhat smaller than the linear dimensions of the tissue region in question. In this case, the dose level from β radiation is proportional to concentration of radioactive material. When estimating dose levels of radioactive iodine isotopes (^{131}I, ^{132}I, ^{133}I, ^{134}I, and ^{135}I) incorporated in the thyroid of experimental animals, the need arises to consider geometric factors (size and shape of the thyroid), since the range of β particles of iodine isotopes in the thyroid is greater than its linear dimensions. For this reason, part of the dose, and for some isotopes the greater part, will be isolated outside the thyroid. Using the formulas for geometric factor for a sphere, the geometric factors were estimated for the rat and dog thyroid of different mass for iodine isotopes, using a Minsk 22 electronic computer. Investigations of dose distribution nonuniformity were carried out using quantitative contrast autoradiography. (CH)

10002 (AEC-tr-7457, pp 108-115) TISSUE DISTRIBUTION OF ^{131}I IN COWS AS RELATED TO DIFFERENT FORMS OF ADMINISTRATION. Sirotkin, A. I.; Panchenko, I. Ya.; Tyumenev, L. N.; Panteleev, L. I.; Nikolaeva, E. M.; Grishin, A. I.; Korneev, N. A. 1972. Translated from pp 72-77 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Radioactive iodine, which is one of the biologically hazardous fallout products of nuclear fission, is taken up by domestic animals chiefly with fodder and water. Since different species of livestock present specific anatomical-physiological distinctions of their digestive systems, there is no reason to maintain that there is the same rate of excretion of radioactive iodine from the GI tract following oral administration of the isotope in the form of aqueous solution and contamination in air of fodder. In addition, there is no reason to state that under these conditions the maximum level of transfer of the radioactive nuclide from solution and fodder to the blood, thyroid, milk, and excreta occurs at the same time after intake of the isotope. In ruminants that have a multichamber stomach with a digestive canal, orally administered isotope in the form of solution may penetrate into the stomach (abomasum) and small intestine, which is the principal site of absorption, without being retained in the first chambers of the stomach (rumen, reticulum, and psalterium). When the radioactive nuclide is administered with plant fodder, it enters the rumen, then, as the food masses are digested, it passes into the reticulum, psalterium, abomasum, and small intestine. Consequently, in the latter event, the isotope remains longer in the GI tract, and the irradiation dose will apparently be greater than when the emitter is administered in solution form. Results are reported from studies of the patterns of transfer of ^{131}I from sodium iodide solution and from fodder contaminated in air with this solution to blood, milk, excreta, and the thyroid gland of lactating cows, following single oral administration of the isotope. The results showed that two, six, and 20 hours after single oral administration of aqueous solution of ^{131}I, 3.6 and 3.9, 4.2 and 1.6, 1.5 and 1.1 times, respectively, more isotope passes from the GI tract into blood and milk of cows, as compared to analogous administration of ^{131}I in contaminated hay. For the first 20 hours after administration of solution, total ^{131}I excretion was 1.2 times greater than in cows that received this isotope with fodder. Thereafter, all these differences disappear. (CH)

10003 (AEC-tr-7457, pp 154-159) PROTECTIVE EFFECTIVENESS OF THYROID-BLOCKING AGENTS IN EXPOSURE TO RADIOACTIVE IODINE. Krasnokutskii, V. M.; Klassovskii, Yu. A.; Vasilenko, I. Ya.; Terekhov, N. F. 1972. Translated from pp 104-108 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Results are reported from a study of the effectiveness of thyroid-blocking agents in protecting the thyroid from radioactive isotopes, ^{131}I and ^{132}I, following administration of different thyrostatic agents before and after radionuclide administration. The experiments on mature animals (15 dogs, 102 mongrel albino rats, and 203 guinea pigs) showed that, of the agents studied, potassium iodide was the best for protection of thyroid tissue from ^{131}I uptake and that it diminished the absorbed dose by 10 to 26 times. Methylthiouracil, methimazole, thyroidin, ammonium perchlorate, and potassium thiocyanate were less effective. Administration of thyrostatic agents after maximum accumulation of radioiodine was ineffective. Thyroid tissue is much less protected from exposure to short-lived isotopes, ^{133}I, ^{135}I, and especially ^{132}I and ^{134}I, than ^{131}I. The shorter the half-life of the isotope, the weaker the protective effect. (auth)

10004 (AEC-tr-7457, pp 160-168) KINETICS OF ACCUMULATION AND TISSUE DOSES IN CHRONIC ADMINISTRATION OF TRITIUM OXIDE TO RATS. Istomina, A. G.; Moskalev, Yu. I. 1972. Translated from pp 108-113 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The kinetics of accumulation of tritium in the rats were studied in relationship to administered activity, and determination of cumulative tissue dose received by animals with chronic intake of HTO. To determine the kinetics of accumulation and elimination of tritium, animals were sacrificed on the 1st, 2nd, 4th, 8th, 16th, 32nd, and 64th days during and following administration of HTO. Some animals were regularly put in metabolic cages and 24-hour urine samples were analyzed radiometrically. Tissue samples obtained at various times were also analyzed radiometrically using dry samples. Results showed tritium is accumulated in soft tissues rather than in bone tissues. Accumulation of tritium in the aqueous phase occurred with a half-life of 3.65 days and in the dry residue at 14.7 days. The mean half-life for the aqueous phase was approximately 3.8 days, and for the dry residue 9 and 50 days. Formulas are presented for estimating the mean concentration of tritium in the rat at any day during administration, as well as after stopping administration. (CH)

10005 (AEC-tr-7457, pp 169-176) TRANSFER OF TRITIUM OXIDE FROM MOTHER TO OFFSPRING WITH MILK AND EFFECTS ON OFFSPRING DEVELOPMENT IN THE POSTNATAL PERIOD. Istomina, A. G.; Lyaginskaya, A. M.; Moskalev, Yu. I. 1972. Translated from pp 113-118 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The pattern of tritium accumulation in offspring due to transfer of tritium from the maternal organism with milk was studied in rats. The results revealed that the histochematological barrier (mammary gland) does not prevent penetration of tritium oxide from blood into milk, and as a result of this, tritium rapidly moves from the maternal organism to the offspring through milk. Tritium causes a mean tissue dose in the offspring that equals the tissue dose in the maternal organism. The radiation dose caused by tritium and incorporated in the dry residue of fetal tissue was 25% larger than in the female (8.6 and 6.9%, respectively). Elimination of tritium from the fetal organism, in the case of single intake, followed an exponential law with two half-lives: 2.2 (68%) and 7.7 days (32%). As tritium accumulated in the offspring there was a decrease in weight gain and higher percentage of deaths. It was also determined that the quantity of milk consumed by a young rat per day constitutes 2 to 2.5 ml. (CH)

10006 (AEC-tr-7457, pp 177-183) TRANSFER OF TRITIUM FROM MOTHER TO OFFSPRING OF DOG. Istomina, A. G.; Poluboyarinova, Z. I.; Kazbekova, D. A.; Zhukova, I. V. 1972. Translated from pp 118-123 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Results are reported from a study of the transfer of tritium to the offspring following single intraperitoneal administration of tritium oxide to a dog, in a dosage of 0.08 μCi/gram half way through the pregnancy. The weight of the bitch was 22 kg. After administration of tritium oxide in the above dosage, the animal developed subacute radiation sickness that changed into the chronic form of illness. The bitch dropped her litter 28 days after administration of tritium oxide. There were 6 pups in the litter (4 males and 2 females), weighing 300 to 340 grams. According to appearance and behavior, the puppies were normally developed. Two pups

were sacrificed immediately after birth for morphological examination and estimation of tritium level in organs and tissues. Four puppies were left for subsequent clinical observation, investigation of blood indices, myelograms of bone marrow imprints, and determination of activity in blood and urine. The cumulative tissue dose received by the fetus did not apparently affect general development in the prenatal period or the first three months after birth (weight gain, opening the eyes, cutting teeth, time of transfer to supplemental food). Minor differences revealed by microscopic examination of tissue samples are described. (CH)

10007 (AEC-tr-7457, pp 211-218) METABOLISM OF ^{137}Cs IN RATS AND ITS RELATION TO K METABOLISM. Dubrovina, Z. V.; Otlygin, V. A.; Sokov, L. A.; Malkina, R. M.; Malkin, P. M. 1972. Translated from pp 140-145 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Results of studies on rats, using ^{137}Cs as a tracer, were indicative of common metabolism of cesium and potassium, and warrant the assumption that there is the same mechanism of intimate metabolic processes in cellular structures. The distribution of ^{137}Cs in organs and tissues depended significantly on the quantity of potassium administered. (auth)

10008 (AEC-tr-7457, pp 225-229) KINETICS OF ^{137}Cs METABOLISM IN CATTLE. Sirotkin, A. N.; Sarapul'tsev, I. A.; Panchenko, I. Ya.; Shilov, V. P.; Samarina, A. A. 1972. Translated from pp 149-151 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The multiplicity factor of accumulation of ^{137}Cs in calves with chronic oral administration from birth increased approximately to the 150th day of administration, then showed a tendency to decrease. Elimination of ^{137}Cs from soft tissues is described by the sum of two exponents, and from the skeletal system by one exponent; 35 to 78% of ^{137}Cs retained in soft tissues at the time administration of this isotope was stopped was eliminated from the calf with a half-life of 3 to 5.9 days, and the rest has a half-life of 56 to 145 days. The half-life of elimination of ^{137}Cs from the skeletal system was 103 days. On the whole, the half-life of elimination of 41% of ^{137}Cs was 3.6 days, and the remaining 59%, 85 days. The decrease in concentration of ^{137}Cs in organs is also described by an exponential equation with approximately the same parameters as elimination. (auth)

10009 (AEC-tr-7457, pp 230-236) INFLUENCE OF RATE OF ADMINISTRATION OF ^{137}Cs ON ELIMINATION THROUGH THE KIDNEYS. Sokov, L. A. 1972. Translated from pp 151-155 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Elimination of ^{137}Cs through the kidneys of rats occurred with the involvement of filtration-reabsorption and secretory-diffusion processes, and the ratio between them depended on the rate of intake of the isotope. In the case of chronic intake of ^{137}Cs with food, elimination in urine was approximately twice as high as following single administration. (auth)

10010 (AEC-tr-7457, pp 278-287) TISSUE DISTRIBUTION OF RADIOACTIVE ISOTOPES OF LANTHANIDE ELEMENTS IN MAMMALS. Moskalev, Yu. I.; Zalikin, G. A.; Stepanov, V. S. 1972. Translated from pp 183-190 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Data are presented on the kinetics of metabolism of nine radioactive isotopes of the lanthanide group, ^{140}La, ^{144}Ce, ^{143}Pr, ^{147}Pm, ^{152}Eu, ^{153}Gd, ^{160}Tb, and ^{161}Tb, and ^{169}Yb in rats. Experiments with ^{144}Ce was also performed on dogs, rabbits, cats, guinea pigs, and rats. Results showed that following intravenous administration of simple salts of radioactive lanthanides, they leave the blood stream relatively rapidly, and are deposited in the liver, skeletal system, and kidneys. Data on the biological half-life are included. Excretion of lanthanides in urine and feces depends appreciably on the atomic weight of the radionuclides. Light elements (cerium, praseodymium, and lanthanum) are excreted primarily (30%) in feces and in negligible quantities in urine (2 to 3%). As the atomic number increases, the percentage eliminated in feces decreases, proportionally to the decline in quantity of the substance accumulated in the liver. Resorption of lanthanides from the GI tract does not exceed 0.05%. In the case of inhalation and intratracheal administration of lanthanides, they are eliminated slowly and incompletely from lung tissue. Resorption constitutes 40 to 60%. (auth)

10011 (AEC-tr-7457, pp 288-296) DISTRIBUTION OF ^{153}Gd IN THE RAT TISSUES. Zalikin, G. A. 1972. Translated from pp 190-197 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Data are presented on the tissue distribution of ^{153}Gd in rats following intravenous and intratracheal administration as chloride or citrate solutions or colloids. (CH)

10012 (AEC-tr-7457, pp 309-321) METABOLISM OF ^{237}Np AFTER INHALATION. Lyubchanskii, E. R.; Levdik, T. I. 1972. Translated from pp 204-214 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Data are reported from a study of ^{237}Np tissue distribution in rats following inhalation. A comparison of metabolic parameters of ^{237}Np compounds in rats and man is included. The lungs and skeletal system are the chief organs of deposition of ^{237}Np following single inhalation of this element in nitrate and oxalate form. In the case of inhaling nitrate, the neptunium level in the lungs is 2 to 2.5 times lower, and in the skeletal system and other organs it is higher than after inhalation of oxalate. Elimination of ^{237}Np from the lungs during the period from 1 to 512 to 650 days shows two half-life periods: 26% (nitrate) and 43.8% (oxalate) of the original level in the lungs is eliminated with a T_{eff} of 15.4 to 22.4 days; 8.1% (nitrate) and 22.6% (oxalate) are eliminated with a T_{eff} of 151 to 168 days. After inhalation of neptunium nitrate and oxalate, 61.1 and 23.4% are eliminated from the skeletal system with a T_{eff} constituting 840 and 2,310 days, respectively. Regardless of the chemical form, the fraction of neptunium resorbed from the lungs is distributed in the skeletal system. The lungs and skeletal system are the critical organs with respect to dosage, and in them neptunium is unevenly distributed. (CH)

10013 (AEC-tr-7457, pp 359-367) SUBCUTANEOUS UPTAKE OF TRANSURANIC ELEMENTS (^{237}Np, ^{239}Pu, and ^{241}Am). Buldakov, L. A.; Nifatov, A. P.; Filippova, L. G.; Khalturin, G. V. 1972. Translated from pp 241-247 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

During the first day after subcutaneous administration to rabbits, 90 to 96.5% of the ^{241}Am, 84 to 96% of the ^{237}Np, and 10 to 80% of the ^{239}Pu were eliminated from the subcutaneous cellular tissues. The rate of elimination of Pu from the injection site was inversely proportional to the isotope concentration in the injected nitrate solution. After 1 to 4 days, the rate of elimination of the three isotopes from the injection site was practically the same, and it was unrelated to the administered dosage. As the isotopes moved farther from the injection site, they accumulated in internal organs. Maximum isotope level in the internal organs was demonstrable on the 64th day. In the liver and skeletal system, ^{241}Am was demonstrable in almost equal quantities, ^{239}Pu was contained primarily in the liver, and ^{237}Np in the skeletal system. A large quantity of ^{239}Pu was demonstrable in the regional lymph nodes. The three isotopes were not similarly distributed in the skin and subcutaneous tissue. Neptunium-237 was distributed diffusely throughout the investigation; after administration of ^{241}Am, a few stars of α-particle tracks were demonstrable in autoradiograms made on the 16th day; and after administration of ^{239}Pu, very dense stars of α-particle tracks were found from the first to the last minutes of the investigation. The microdistribution in internal organs was the same for the three isotopes. Diffuse tracks were located in all structural elements of the liver, kidneys, bone marrow, and bones. As time passed, there was an increase in quantity of tracks in the internal organs. The smallest amount of tracks was found after administration of colloids of ^{239}Pu. (auth)

10014 (AEC-tr-7457, pp 368-380) UPTAKE OF ^{239}Pu AND DYNAMICS OF MORPHOLOGICAL CHANGES IN THE RAT LUNGS FOLLOWING CHRONIC INHALATION AS Pu CITRATE COMPLEX. Koshurnikova, N. A.; Poplyko, M. G.; Erokhin, R. A.; Iovlev, I. V. 1972. Translated from pp 248-257 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

10015 (AEC-tr-7457, pp 412-426) METABOLISM OF ^{241}Am AFTER INHALATION. Lyubchanskii, E. R.; Nifatov, A. P. 1972. Translated from pp 279-291 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The deposition of ^{241}Am in the rat lungs (~24% of inhaled dose) was unrelated to chemical form and concentration of the isotope in the inhaled air. The lungs, skeletal system, and liver were the principal organs of deposition of ^{241}Am when soluble compounds were inhaled. Clearance of ^{241}Am from the lungs in the interval of 1 to 650 days was related to three half-lives: T_{eff} is 6.9 to 8.1 days for 49.4 to 51.9% of the initial lung content, T_{eff} = 64 to 67 days for 2.56 to 2.60%, and T_{eff} = 856 to 1,295 days for 0.61 to 0.81%. Regardless of the type of Am compound, it was unevenly distributed in the lungs. After inhalation of ^{241}Am citrate and nitrate, 20.3 to 21.8% of the initial lung content was eliminated from the skeletal system with T_{eff} = 1,915 to 2,170 days. The microdistribution of this isotope in bones was nonuniform and characterized by predominant localization of tracks in the periosteum. T_{eff} = 215 to 352 days for elimination of the isotope from the liver (2.6 to 4.3%). Tracks of α particles were evenly distributed in the liver. After single inhalation of soluble ^{241}Am compounds, the rat lungs were the critical organ, with respect to absorbed dose. Deposition of ^{241}Am in the rat lungs and skeletal

system, expressed as share of inhaled dose, as well as the biological half-life for elimination from the skeletal system, expressed as percentage of mean rat survival, are close to the corresponding parameters used as the standard for man. (auth)

10016 (AEC-tr-7457, pp 427-434) DISTRIBUTION OF ^{241}Am IN RATS AS RELATED TO THE PROPERTIES OF THE ADMINISTERED SALT. Zalikin, G. A.; Trifonov, V. I. 1972. Translated from pp 292-297 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The distribution of ^{241}Am in rats following intravenous administration of soluble salts (nitrates, chlorides, and citrates) of this isotope was found to be little related to the properties of the administered salt. The ^{241}Am content of the skeletal system following intravenous administration of soluble salts did not exceed 21% of the administered dose. In the case of intravenous injection of the polymeric form of ^{241}Am hydroxide, an additional reservoir of the isotope was formed in the lungs where up to 44% of the injected dose was retained. (auth)

10017 (AEC-tr-7457, pp 435-440) MICRODISTRIBUTION OF ^{241}Am IN RAT ORGANS FOLLOWING INTRAPERITONEAL AND INTRATRACHEAL ADMINISTRATION. Puzyrev, A. A.; Nifatov, A. P. 1972. Translated from pp 298-302 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

10018 (AEC-tr-7457, pp 441-445) TISSUE DISTRIBUTION OF ^{244}Cm IN RATS. Semenov, A. I. 1972. Translated from pp 302-305 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

When administered intravenously to rats in the form of chloride solution (pH 3.0), ^{244}Cm rapidly cleared from the blood stream and was accumulated primarily in the liver (51.27%) and skeletal system (22.3%). In 10 days, 50% of the activity was eliminated from the liver, but ^{244}Cm was virtually not eliminated from the skeletal system. It was eliminated chiefly through the gastrointestinal tract and feces. Resorption from the GI tract was about 0.02%. (auth)

10019 (AEC-tr-7457, pp 446-454) BIOLOGICAL EFFECTIVENESS OF ^{241}Am FOLLOWING ORAL AND PARENTERAL ADMINISTRATION. Buldakov, L. A.; Nifatov, A. P. 1972. Translated from pp 305-311 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

The toxicity of ^{241}Am citrate and nitrate, when administered to rats intraperitoneally, was similar, and when administered by mouth ^{241}Am citrate was more toxic. With oral administration, the toxicity of ^{241}Am was 122 to 185 times lower than with parenteral administration of the isotope. The $LD_{30/30}$ with parenteral administration was 10.7 μCi/kg/day; $LD_{50/90}$ for intraperitoneal and oral administration was 1.38 and 200 μCi/kg/day, respectively. The dosage that did not shorten survival time was 0.005 μCi/kg with daily parenteral administration and 0.85 μCi/kg with oral administration. The safe radiation dose in the skeletal system was 1.46 rads/day for intraperitoneal administration and 0.23 rad/day for oral administration. According to the body weight loss criterion, the safe level of ^{241}Am was less than 0.52 μCi/kg with oral administration. The severity of leukopenia with intraperitoneal administration and of anemia and thrombocytopenia with oral administration increased with increase in dosage of ^{241}Am. According to the leukopenic effect (0.0035 μCi/kg), thrombocytopenic effect (0.0068 μCi/kg), and according to the erythrocyte reaction (0.035 μCi/kg), the safe level of ^{241}Am is lower with intraperitoneal administration than with oral intake. (auth)

10020 (AEC-tr-7457, pp 505-509) COMPARTMENT MODEL OF RADIOISOTOPE TISSUE DOSE DISTRIBUTION USING THE MINSK 22 COMPUTER. Lutsyk, S. P.; Ognev, B. I. 1972. Translated from pp 345-348 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

Increasing use is being made of systems based on a compartment model of isotope metabolism after entry in the organism in problems related to the kinetics of metabolism of radioactive isotopes, and in particular to estimate the doses of internal tissular irradiation. The practical use of such systems requires complex calculations and, for this reason, would be inconceivable without using modern computer technology. The Minsk 22 electronic computer was used for two applications of the compartment model. In the first case, the problem of calculating absorbed dose and concentration of ^{137}I in the thyroid after single and chronic intake of a mixture of ^{131}I and ^{132}Te was solved. In the second instance the concentrations of ^{90}Sr and ^{90}Y, and the doses they produced in bone tissue after single and continuous intake of a mixture of ^{90}Sr and ^{90}Rb, were calculated. (CH)

10021 (AEC-tr-7457, pp 510-515) KINETICS OF METABOLISM OF SOME RADIOISOTOPES IN FISH AS RELATED TO WATER TEMPERATURE AND SALINITY. Nechaev, L. N.; Lyapin, E. N.; Gusev, D. I.; Katkov, A. E.; Podgurskii, A. M. 1972. Translated from pp 348-352 of Biologicheskoye Deystviye Vneshnikh i Vnutrennikh Istochnikov Radiatsii, Moscow, Meditsina, 1972.

On the 20th day, the coefficients of accumulation of radioisotopes (^{51}Cr, ^{59}Fe, ^{60}Co, ^{89}Sr, ^{90}Sr, ^{125}Sb, ^{144}Ce, ^{137}Cs) in fish tissues, in cold water, constituted 30 to 60% of the accumulation coefficients for warm water. When salinity of warm water was increased to 10% the accumulation coefficients of fish tissues drop by about 70%. A tendency was demonstrated toward slower elimination of the isotope from gills, superficial tissues, and internal organs at a temperature of 0°. We failed to detect differences in the nature of isotope elimination from fish kept in fresh and salt water of the same temperature. The dynamics of relative distribution of the isotopes studied in different tissues, in the course of accumulation and elimination, demonstrated a greater correlation to temperature than salinity of water. The maximum quantity (>85%) of isotopes was contained in the unedible parts of the fish (surface tissues, gills, and viscera). In the course of culinary handling or the preparation of filets or canned fish, 90 to 97% of the isotopes (with the exception of ^{137}Cs) was removed. (auth)

10022 (COO-1156-69) STRONTIUM KINETICS IN MULE DEER. Schreckhise, R. G. (Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). May 1974. 82p. Dep. NTIS $7.25.

Thesis.

The effects of age and season on the kinetics of strontium in mule deer (Odocoileus hemionus heminous) were studied. Male and female deer of various ages were given, at selected times throughout the year, acute oral doses of approximately 1.0 mCi $^{85}SrCl_2$ via drinking water. The deer were periodically whole-body counted for an average of 264 days after spiking to determine ^{85}Sr body burdens as a function of time after ingestion. A two-component exponential equation provided the best mathematical description of the retention of acutely administered ^{85}Sr. (CH)

10023 (LF-tr-81) STUDIES OF THE ^{90}Y DISTRIBUTION IN ANIMAL ORGANS USING ESPECIALLY AUTORADIOGRAPHIC AND PAPER-ELECTROPHORESIS DETECTION METHODS. Graul, E. H.; Hundeshagen, H. Translated from Strahlentherapie; 106: 405-417(1958). 20p. Dep. NTIS $4.00.

The metabolism of yttrium-90 was investigated through determination, by the usual measuring methods, of the specific activity (counts per minute per gram) and total activity of various organs. Also, microautoradiographs (stripping-film method) were made of each organ, and electrophoretic serum and organ-protein analyses were run. The experimental animals were guinea pigs. With a constant addition of carrier of Y^{3+}/1mC, the yttrium-90 was applied intraperitoneally, intracardially, and orally. Depending on the mode of application, high specific activities are observed in organs important for the overall metabolism, e.g., the pancreas and pituitary. On the basis of the autoradiographs and results of the paper electrophoresis, an attempt was made to interpret the measurements. (auth)

10024 (LF-tr-82) DISTRIBUTION OF RADIOYTTRIUM AND RADIOACTIVE RARE EARTHS IN THE MAMMALIAN ORGANISM. I. Distribution Experiments with Carrier-Free Radioyttrium (^{91}Y) in Guinea Pigs. Spode, E. Translated from Z. Naturforsch., b; 13b: 286-291(1958). 12p. Dep. NTIS $4.00.

The distribution of ^{91}Y was followed in guinea pigs during 14 days following intraperitoneal or subcutaneous injection as $^{91}YCl_3$. Results showed retention in bone tissues after 14 days. (CH)

10025 (LF-tr-83) DISTRIBUTION OF CARRIER-FREE RADIOLANTHANUM (^{140}La). Spode, E.; Gensicke, F. Translated from Naturwissenschaften; 45: No. 6, 135-136(1958). 4p. Dep. NTIS $4.00.

The distribution of ^{140}La was followed in mice during seven days following subcutaneous or intraperitoneal injection as $^{91}La\ Cl_3$. Uptake and retention in the liver was marked. (CH)

10026 (LF-tr-85) DISTRIBUTION OF RADIOYTTRIUM (^{91}Y) IN THE ANIMAL ORGANISM. Spode, E.; Gensicke, F. Translated from Naturwissenschaften; 44: No. 5, 118-119(1957). 4p. Dep. NTIS $4.00.

The distribution of ^{91}Y was followed in mice during 30 days following subcutaneous or intraperitoneal injection of $^{91}Y\ Cl_3$. Results showed that the distribution pattern depends on the route of administration. (CH)

10027 (LF-tr-86) DISTRIBUTION OF RADIOYTTRIUM AND RADIOACTIVE RARE EARTHS IN THE MAMMALIAN ORGANISM. IV. Investigations of the Metabolism of Radiopraseodymium (^{143}Pr) in Mice. Gensicke, F.; Henneberger, G. Translated from Z. Naturforsch., 19B: 893-899(1964). 14p. Dep. NTIS $4.00.

The absorption, organ storage, and excretion of radiopraseodymium (^{143}Pr) after subcutaneous and intraperitoneal injection in mice is described. Radiopraseodymium administered in the form of praseodymium chloride is absorbed only very slowly and accumulates mainly in the liver and the skeletal system. The addition of an inactive isotope carrier as well as variation of the pH of the injected solution considerably influences the metabolism of ^{143}Pr. The results are compared with those obtained after parenteral application of ^{144}Ce and ^{90}Y and ^{91}Y. (auth)

10028 (LF-tr-87) CONCERNING THE METABOLISM OF RADIOSAMARIUM (^{153}Sm) IN THE WHITE MOUSE. Spode, E.; Gensicke, F. Translated from Naturwissenschaften; 47: 542(1960). 5p. Dep. NTIS $4.00.

The distribution of ^{153}Sm was followed in mice during six days following intraperitoneal or subcutaneous injection of $^{153}SmCl_3$. Retention in the liver and bone tissues was noted. (CH)

10029 (LF-tr-88) PROBLEM OF THE DISTRIBUTION OF RADIOLUTETIUM (^{177}Lu) IN THE MOUSE ORGANISM WITH DIFFERENT ROUTES OF ADMINISTRATION. Spode, E.; Gensicke, F.; Glaser, R. Translated from Experientia; 14: No. 12, 456-457 (1958). 6p. Dep. NTIS $4.00.

A report is presented of study of the absorption, distribution, and excretion of $^{177}LuCl_3$ at periods of up to 30 days following subcutaneous and intraperitoneal injection of 4 μCi of ^{177}Lu in mice. The isotope exhibits certain differences in its biological behavior as compared with the light rare earths such as lanthanum and cerium. (auth)

10030 (LF-tr-89) INVESTIGATIONS ON THE BEHAVIOR OF RADIOHOLMIUM (^{166}Ho) IN THE ORGANISM OF THE WHITE MOUSE. Spode, E.; Gensicke, F.; Glaser, R. Translated from Strahlentherapie; 108: No. 1, 97-101(1959). 9p. Dep. NTIS $4.00.

A report is presented of a study on the distribution of ^{166}Ho in the organism of the mouse after subcutaneous and intraperitoneal injections. The special significance of the dose by weight is indicated. Radioholmium used in the described form appears to be suitable for use in interstitial tumor therapy. (auth)

10031 (LF-tr-90) TRANSPORT MECHANISM OF RADIONUCLIDES IN BLOOD. 1. The Transport of ^{144}Ce, ^{147}Pm and $^{90,91}Y$ in Mouse Serum. Gensicke, F. Translated from Strahlentherapie; 118: 369-374(1962). 9p. Dep. NTIS $4.00.

The transport of cerium-144, promethium-147, and radioyttrium in serum is reported. It could be observed that 15 and 30 min after intravenous or intraperitoneal injection the radionuclides mentioned do not form compounds with proteins and lipoproteins. It is very probable that ^{144}Ce and ^{147}Pm are transported as metal-citrate complexes in the serum. The same transport mechanism must be assumed, partly, for radioyttrium. (auth)

10032 EFFECTS OF CAPILLARY BLOCKADE WITH ^{99m}Tc-IRON HYDROXIDE: A HISTOPATHOLOGIC STUDY. Davis, M. A.; King, M. F. (Harvard Medical School, Boston). J. Nucl. Med.; 15: No. 6, 436-438(Jun 1974).

Twenty-six mice injected with ^{99m}Tc-ferrous hydroxide macroaggregates (Tc-FHMA) were sequentially sacrificed over a 40-week period. Histologic sections of lung tissue stained for iron or with hematoxylin-eosin were prepared. Microscopic examination revealed changes in particle size and location of the FHMA with time after administration. Several mechanisms of clearance such as aggregate breakup, particle dissolution, and cellular phagocytosis were evident. The major finding was the complete absence of pathologic lesions that could be attributed to the long-term residence of Tc-FHMA in the pulmonary capillaries. (auth)

10033 FLUX OF ^{141}Ce THROUGH A EUPHAUSIID CRUSTACEAN. Fowler, S. W.; Heyraud, M.; Small, L. F.; Benayoun, G. (International Atomic Energy Agency, Monaco). Mar. Biol.; 21: No. 4, 317-325(Aug 1973).

The role of the Mediterranean euphausiid Meganyctiphanes norvegica in the cycling of radiocerium (^{141}Ce) was examined. When uptake of ^{141}Ce occurs directly from the water, a dynamic population equilibrium is reached at a concentration factor of about 250. Molting was responsible for up to 99% loss of total body burden at first molt, and about 45% of the remaining activity at second molt, thus denying true longterm equilibrium to individual animals. Fecal pellets did not contain measureable ^{141}Ce activity when the euphausiids accumulated the isotope from water, thus proving that surface adsorption was the key accumulating process from water. When radiocerium was taken in through ingestion of labeled Artemia, about 99% of the body burden was voided as fecal pellets. Excretion by this route was accelerated when euphausiids were fed non-radioactive Artemia during loss phase. Radioactive counts of the pellets confirmed that all ingested ^{141}Ce was lost through defecation. When ^{141}Ce was ingested as labeled phytoplankton, a substantial fraction of the total body burden occurred in the molts, which indicated that the phytoplankton lost ^{141}Ce to the water and the radioactivity was subsequently adsorbed to outer surfaces of the euphausiids. Molts, fecal pellets, and freshly-killed euphausiids lost ^{141}Ce to the water exponentially, the rates being similar to the exponential portions of the loss curves for live, non-molting individuals. It is suggested that M. norvegica, and probably other pelagic zooplankters, can greatly accelerate radiocerium transport to the ocean floor by packaging the isotope as fecal pellets. In coastal areas subject to low-level radioactive waste disposal, ^{141}Ce might be ionic (or at least soluble) to a great extent, in which case euphausiids could take up the isotope rapidly and accelerate its vertical transport via molting. (auth)

10034 TOXICITY OF INHALED $^{144}CeO_2$ IN MICE. Lundgren, D. L.; McClellan, R. O.; Thomas, R. L.; Hahn, F. F.; Sanchez, A. (Inhalation Toxicology Research Inst., Albuquerque, NM). Radiat. Res.; 58: No. 3, 448-461(Jun 1974).

One hundred and seventy-eight mice, exposed by inhalation to an aerosol of $^{144}CeO_2$ particles, were observed for their lifespan and their survival compared with those of 200 unexposed control mice. Approximately 91% of the initial whole-body burden of ^{144}Ce was cleared within 6 days. The whole-body burden at 6 days was estimated to be equivalent to the initial lung burden (ILB) of which 32% was retained with an effective half-time of 7 days, 49% with a half-time of 28 days, and 19% with a half-time of 145 days. Cerium-144 retained in the lungs as a percentage of whole-body burden at death was determined through day 454 postinhalation exposure to be 84%. Mean survival time and cumulative percentage of survival were related to the estimated ILBs; ILBs of 4 to 5 μCi or greater resulted in 62% or more shortening of lifespan and ILBs of 3 to 4 μCi resulted in a 24% shortening of lifespan. The dose of beta radiation to the lung to the day of death ranged from 10,000 to 32,000 rads. No malignant primary pulmonary tumors were observed in the mice that had inhaled $^{144}CeO_2$ particles. (auth)

10035 CARBON-MERCURY BOND CLEAVAGE IN BLOOD OF RATS FED METHYL MERCURIC CHLORIDE. Garcia, J. D.; Yang, M. G.; Wang, J. H. C.; Belo, P. S. (Michigan State Univ., East Lansing). Proc. Soc. Exp. Biol. Med.; 146: No. 1, 66-70 (May 1974).

Methyl mercuric chloride labeled with ^{14}C or ^{203}Hg or both were force-fed to rats in order to quantitatively determine breakage of the carbon-mercury bond in different fractions of blood. Based on the hypothesis that a change in the ratio of ^{14}C to ^{203}Hg radioactivities in the tissue from that in the compound fed to rats would indicate breakage, values ranging from 5.1% to 10.6% were observed depending upon the blood fraction studied. Since the site of deposition of mercurial compounds is important in determining toxicities, the concentrations of either ^{14}C or ^{203}Hg radioactivities in blood fractions were determined after force-feeding the single or double-labeled methyl mercuric chloride. One day after force-feeding, the highest concentration in the erythrocytes was in the hemoglobin. In the plasma, fat contained the highest concentration. However, plasma fat radioactivities constitute only 0.1% of the whole blood radioactivities whereas plasma protein radioactivities constitute 0.7%. Nearly 99% of blood radioactivities was in the hemoglobin. (auth)

10036 EFFECT OF SYNTHETIC SALMON CALCITONIN ON IODINE METABOLISM IN RABBITS. Lupulescu, A.; Stebner, F. (Wayne State Univ., Detroit). Proc. Soc. Exp. Biol. Med.; 146: No. 1, 56-58(May 1974).

Long-term administration of synthetic salmon calcitonin to rabbits markedly decreases the radioiodine (^{131}I) uptake in the thyroid gland as well as in the plasma. Protein-bound iodine and thyroxine serum levels are also decreased. In contrast, the renal iodine clearance is much increased in calcitonin-treated rabbits as compared to controls or to vehicle alone. This ioduric effect of salmon calcitonin can explain its role in goiter induction. (auth)

10037 CHELATION OF ^{241}Am FROM THE LIVER AND SKELETON OF THE ADULT BABOON. Cohen, N.; Guilmette, R. A.; Wrenn, M. E. (New York Univ. Medical Center). Radiat. Res.; 58: No. 3, 439-447(Jun 1974).

Investigations have been performed to evaluate DTPA effectiveness in the removal of ^{241}Am from the adult baboon. By administering therapy at long as well as at shorter times after single iv injections of ^{241}Am, it was possible to study the efficacy of DTPA therapy as a function of the site of its deposition in the primate, i.e., the skeleton and/or the liver. Measurements of concentration changes effected in the bone and liver were performed by monitoring ^{241}Am in tissue biopsy specimens, in vivo scintillation counting, and routine radiochemical analysis of excreta. In that animal with an established bone burden of ^{241}Am, a total of 8% of the body burden was removed due to DTPA administered over a 3-wk period, at a treatment regimen duplicating that presently used for man. Approximately 15% of the body burden was re-

moved during a similar time period from an animal still having a significant fraction of its burden in the liver. Partition of activity excreted as a result of chelation therapy was monitored by daily analysis of urine and feces. (auth)

10038 ISOTOPE STUDY ON THE UTILIZATION OF PHOSPHORUS INTRODUCED AS DICALCIUM PHOSPHATE IN FARM ANIMALS. II. Studies in Hens. Vrigazov, A. (Akademiya na Selskostopanskite Nauki, Sofia); Gromkov, N.; Simeonov, S.; Andreev, A. Vet. Med. Nauki (Sofia); 9: No. 8, 3-8(1972). (In Bulgarian).

Trials were carried out with 8 hens divided into three groups: I and II with three birds each, and III, with two birds, to study the utilization of phosphorus, labelled as ^{32}P in dicalcium phosphate ($CaHPO_4$). The birds of group I were killed three days following the introduction of the preparation, those of group II were killed on the sixth day, and those of group III on the ninth day. The preparation was introduced singly per os at the rate of 20 mCi/kg body weight parallel with 1 g of nonradioactive dicalcium phosphate as a carrier substance. The elimination of ^{32}P with the feces and the eggs layed, as well as its deposition in the femoral bones and the viscera (stomach, intestines, liver, spleen) and the brain were determined radiometrically. It was established that ^{32}P is eliminated with the mixed excreta, the peak being reached during the first 24 to 48 hours following administration. It is eliminated at negligible rates with the eggs. From 75 to 80% ^{32}P was retained in birds. Thus it was established that the phosphorus of dicalcium phosphate is retained in the body of chickens, especially in bone tissues. (auth)

10039 STUDIES WITH ^{113}Sn ON THE RESORPTION AND EXCRETION OF PARENTERALLY ADMINISTERED TIN. Kutzner, J.; Brod, K. H. (Univ., Mainz). Nucl.-Med.; 12: No. 4, 320-327(Jan 1974). (In German).

Whereas increased organ uptake after oral administration of tin could not be demonstrated with certainty, uptake in bone was observed after parenteral application of ^{113}Sn. Tin is primarily excreted via the kidneys and to a small extent through the feces. If tin is administered in the physiological pH range, formation of colloid and consequently uptake in the RES of the liver and spleen takes place. (auth)

10040 RELATIONSHIP BETWEEN THYROGLOBULIN SYNTHESIS AND INTRATHYROID IODINE METABOLISM AS INDICATED BY THE EFFECTS OF CYCLOHEXIMIDE IN THE RAT. Vagenakis, A. G.; Ingbar, S. H.; Braverman, L. E. (St. Elizabeth's Hospital, Boston). Endocrinology; 94: No. 6, 1669-1680 (Jun 1974).

The effect of small doses of cycloheximide (CH) (0.5 μg/g body wt) on the intrathyroid metabolism of carrier-free ^{131}I and stable iodide in iodine-sufficient and iodine-deficient rats and on thyroglobulin (Tgb) maturation in iodine-deficient rats was studied. This dose of CH had no apparent toxicity but strikingly inhibited the incorporation of ^{14}C-labeled amino acids into thyroid and plasma proteins. In iodine-sufficient rats, CH did not affect T/S (I^-) ratios, but did enhance the sensitivity of the thyroid to the acute inhibitory effects of stable iodide on the organification mechanism (Wolff-Chaikoff effect). CH produced unusual effects on the intrathyroid metabolism of ^{131}I in these iodine-sufficient rats: a decrease in ^{131}I uptake, an increase in labeled DIT and a decrease in MIT so that MIT/DIT ratio declined, and a decrease in the proportionate synthesis of the iodothyronines (T_4 and T_3). In iodine-deficient rats, CH also sensitized the thyroid to the acute Wolff-Chaikoff effect but produced changes in the other aspects of thyroid iodide metabolism which differed from those found in iodine-sufficient animals. Thus, CH increased the T/S (I^-) ratio and strikingly increased the proportionate synthesis of T_4 following the administration of carrier-free ^{131}I. The effects of CH on the intrathyroidal metabolism of carrier-free ^{131}I in these iodine-deficient rats were similar to those produced by a single small dose of stable iodide given 6 hr prior to the ^{131}I: decreased ^{131}I uptake, decreased MIT/DIT ratio and increased proportionate synthesis of T_4. In the iodine-deficient rat, CH administration led to a shift in the sedimentation characteristics of Tgb from the slowly-sedimenting immature Tgb characteristic of the poorly iodinated protein to the more rapidly sedimenting, mature 19S Tgb characteristic of the well-iodinated protein. As observed above for the qualitative effects of CH on iodoamino acid synthesis, this change in Tgb maturation mimicked precisely that produced by small doses of iodide in the iodine-deficient rat. It is suggested that the nature of the iodoamino acids synthesized and the maturation of Tgb depends on the ratio of prethyroglobulin to the quantity of iodine available for iodination. In the iodine-deficient animal, the decreased synthesis of prethyroglobulin induced by CH may provide a more favorable iodine/prethyroglobulin ratio, producing effects on iodoamino acid synthesis and Tgb maturation similar to those produced by iodide administration alone. (auth)

10041 EXPERIMENTAL INVESTIGATIONS OF ^{137}Cs REMOVAL BY PERITONEAL DIALYSIS. III. Dziuk, B. (Wojskowa Akademia Medyczna, Warsaw). Pol. Arch. Med. Wewn.; 49: 223-227(1972). (In Polish).

Intermittent peritoneal dialysis with potassium-free fluid was used for removal of ^{137}Cs from the organism of rabbits. During a dialysis of 105 min duration 4.94 ± 1.11% of the administered dose of the isotope was removed. During dialysis with potassium-free fluid, hypokalemia developed which could have been the cause of increased urinary excretion of ^{137}Cs (7.43 ± 1.93% of the administered dose). The metabolic properties of potassium and cesium in the organism of man and animals are compared. (auth)

10042 CHEMICAL AND RADIOCHEMICAL METHODS OF INVESTIGATION OF THE TRANSPORT-ORGANIC STAGE OF IODINE METABOLISM. Varnovitskii, E. G. Med. Radiol.; 19: No. 4, 83-88(Apr 1974). (In Russian).

A bibliographic review is given of the development of chemical and radiochemical methods for the study of iodine metabolism in mammals using ^{125}I and ^{131}I as tracers. (54 references) (JSR)

10043 EXPERIMENTAL VALIDATION OF A DOSIMETRIC MODEL OF THE GASTROINTESTINAL TRACT IN CATTLE. Osanov, D. P.; Prister, B. S.; Panova, V. P.; Riabov, G. G.; Burov, N. I.; Shaks, A. I. (Inst. of Biophysics, Moscow). Health Phys.; 26: No. 6, 497-503(Jun 1974).

A three-compartment dosimetric model of the gastrointestinal tract (GI tract) of cattle is constructed and the main parameters of this model (distribution of contents in the GI tract divisions, mean time of contents stay in each division, and the effective transport rate constants) are experimentally determined. This model permits one to calculate the mean absorbed doses in the GI tract divisions with accuracy ranged in ± (5 + 30) % and can be useful for practical aims. (auth)

10044 EXPERIMENTAL INVESTIGATIONS OF THE KINETICS OF ^{119m}Sn. Glaubitt, D.; Roedler, H. D.; Marx, R.; Schaefer, H. (Freie Univ., Berlin). Atomkernenergie; 22: No. 4, 279-281 (1973). (In German).

From annual meeting of the Deutsche Gesellschaft fuer Biophysik; Juelich, Ger. (27 Sep 1973).

The kinetics of ^{119m}Sn after intravenous injection of 20 μCi of ^{119m}Sn-hexachlorostannate(IV) was examined in male Wistar rats for 19 weeks. A slow and a rapid component of the effective half-time of ^{119m}Sn in the total body and in 5 organs were observed. The highest distribution factors were found in liver, total skeleton, and kidneys both in the rat and in man. The relative initial concentrations of radiotin were highest in liver, spleen, and kidneys in the rat as well as in man. Provided that in man the distribution patterns of ^{113}Sn which is eluted from generator columns is similar to the distribution of ^{119m}Sn hexachlorostannate(IV) in the rat, a radiation burden of liver, spleen, and kidneys must chiefly be taken into account if ^{119m}Sn eluted together with ^{113m}In is injected intravenously. (auth)

10045 EXCHANGE OF RADIOIODINE IN PREGNANT AND FETAL SHEEP. Book, S. A.; Wolf, H. G.; Parker, H. R.; Bustad, L. K. (Univ. of California, Davis). Health Phys.; 26: No. 6, 533-539(Jun 1974).

The exchange of radioiodine between maternal blood, fetal blood, and amniotic fluid was studied in sheep in the 120 to 125th day of gestation. A double-tracer technique, using ^{131}I and ^{125}I, and a surgical procedure for in utero sampling of fetal blood and amniotic fluid permitted quantitation of the radionuclides transferred between the fluid compartments up to 48 h after injection. Rapid exchange of the radioiodines was observed between dam and fetus and between fetus and amniotic fluid. Regardless of the injected compartment, the 48-h concentration of radioiodine in amniotic fluid exceeded that of fetal blood which, in turn, was greater than that in maternal blood; the concentration in thyroid glands varied with the injection site. Maternal and fetal thyroid glands contained 14 and 7.7% of the injected dose, respectively, after maternal injections; 5.7 and 4.2% after fetal injection; and 0.9 and 1.5% after amniotic fluid injection. Fetal/maternal ratios of radioiodine per gram of thyroid gland were 4.8 after maternal injection, 6.2 after fetal injection, and 21 after injection into the amniotic fluid. The amniotic fluid may serve as a reservoir for iodine for the fetus, accounting for the greater concentration of radioiodine in the fetal thyroid gland compared to the dam's in advanced pregnancy. (auth)

10046 DECONTAMINATION OF SWINE, SHEEP, AND CATTLE SURFACE-CONTAMINATED WITH FISSION PRODUCTS. II. Removal of Radionuclides of Zirconium, Niobium, Ruthenium, and Cerium. Havlicek, F.; Hrusovsky, J.; Mach, J. (Vojensky Veterinarni Vyzkummy Ustav, Prague). Voj. Zdravot. Listy; 42: No. 4, 177-179(Jul 1973). (In Czech).

The decontamination efficiency was studied of water and various chelating agents, complex-forming agents, and commercial de-

tergents in swine, sheep, and cattle experimentally contaminated with ^{95}Zr-^{95}Nb, ^{106}Ru, and ^{144}Ce. For the radionuclides investigated, as 1% solution of EDTA and Jar-extra (commercial detergent) in combination was found to show the optimum decontamination ability. The use of EDTA and Jar-extra solutions alone, or water alone showed lesser ability. The experiment followed up on a study into the decontamination of farmyard animals surface-contaminated with Cs, Sr, and I. (INIS)

10047 RETENTION OF INHALED ANTIMONY-124 IN THE BEAGLE DOG AS A FUNCTION OF TEMPERATURE OF AEROSOL FORMATION. Felicetti, S. W.; Thomas, R. G.; McClellan, R. O. (Lovelace Foundation for Medical Education and Research, Albuquerque, NM). Health Phys.; 26: No. 6, 525-531(Jun 1974).

To evaluate the influence of varied thermal treatment on the biological behavior of radio-antimony aerosols, groups of three dogs were exposed to aerosols that had been nebulized from a ^{124}Sb-tartrate complex and passed through a heating column maintained at 100, 500, or 1000°C. The resulting particles had activity median aerodynamic diameters of 1.3, 1.0, and 0.3 μm, with respective σ_g's of 1.6 and 1.3, indicating that increasing the temperature decreased the mean particle size of the aerosol. The aerosol with largest particle size, generated at 100°C, showed the least overall whole-body retention, due mostly to rapid early clearance. Much of this aerosol was cleared from the upper respiratory tract or was solubilized in the lung and excreted in the urine. The 500°C aerosol was retained to a greater extent than the 1000°C aerosol, both in the lungs and whole body. Average long-term biological half-lives were 100, 36, and 45 days for the 100, 500, and 1000°C aerosols, respectively. Elimination occurred in both urine and feces, with urine/feces ratios for individual collections generally less than 1. Red blood cells were observed to concentrate ^{124}Sb. One dog from each group was sacrificed at 32, 64, and 128 days post-exposure. In the tissues, ^{124}Sb concentrations were highest in the lung, thyroid, liver, and pelt. At 100°C the thyroid concentrated ^{124}Sb to a greater extent than any other tissue. With the 500 and 1000°C aerosols, the lungs contained the highest concentrations of ^{124}Sb, followed by the thyroid. The pelt concentrated ^{124}Sb to a rather large extent and because of its size, contained a considerable portion of the body burden at all sacrifice times for all three aerosols. Skeleton and liver also concentrated ^{124}Sb. (auth)

10048 LUNG CONTAMINATION BY Ce AND La EVOLUTION OF THE EARLY SPONTANEOUS ABSORPTION AS A FUNCTION OF THE INITIAL LUNG BURDEN. Ducousso, R.; Pasquier, C. (Service de Sante des Armees, Fontenay-aux-Roses, France). Health Phys.; 26: No. 6, 519-524(Jun 1974).

In order to measure in the monkey the early spontaneous absorption of Ce and La following inhalation, as a function of the initial lung burden, a device was developed allowing focus of the study on the deeper lung and standardization of the experimental parameters. The initial lung burdens varied between 10^{-2} and 10 μg; for lung burdens over 10^{-1} μg the activity transported within 1 h was always found to be under 10% of the initial burdens. Ce behaved as La, for the same deposit. (auth)

10049 DISTRIBUTION OF RADIOACTIVE PHOSPHORUS (^{32}P) IN THE TISSUES AND ORGANS OF MICE OF PURE LINES AND F_1 (KP × KE) HYBRIDS. Manowska, J. (Univ., Jagiellonian, Krakow). Folia Biol. (Krakow); 22: No. 1, 73-78(1974).

Experiments with mice of the pure KP, C57B strains and F_1 (KP × KE) hybrids showed that radioactive phosphorus (^{32}P) accumulates in the organs and tissues of the pure line mice in much larger amounts than in the hybrids. The greatest differences were observed between the KP mice and hybrids. Cumulation of ^{32}P in the adrenals showed no statistically significant differences between pure line mice and hybrids. The greatest cumulation of ^{32}P was observed in the vertebral columns of hybrids and the lowest in the mice of the KP strain. (auth)

10050 REMOVAL OF ^{144}Ce IN FUSED CLAY PARTICLES FROM THE BEAGLE DOG LUNG BY BRONCHOPULMONARY LAVAGE. Boecker, B. B.; Muggenburg, B. A.; McClellan, R. O.; Clarkson, S. P.; Mares, F. J.; Benjamin, S. A. (Lovelace Foundation for Medical Education and Research, Albuquerque, NM). Health Phys.; 26: No. 6, 505-517(Jun 1974).

The effectiveness of repeated bronchopulmonary lavage for removing inhaled ^{144}Ce fused clay particles from the lungs of Beagle dogs was investigated. Twelve Beagle dogs were exposed to a ^{144}Ce fused clay aerosol resulting in initial lung burdens ranging from 47 to 64 μCi/kg body weight. Eight received 10 saline lavage treatments, five on each lung over a 56-day period. At the end of each lavage, they received 50 mg of calcium diethylene-triaminepentaacetic acid (DTPA) intravenously. Four dogs received no treatment. A second group of four dogs was exposed to an aerosol of fused clay only and given 10 lung lavages over a 56-day period. In the eight treated dogs, an average of 44% of initial lung burden was removed by the 10 lavage procedures. Recovery from two of these eight dogs was considerably lower, 23 and 27%, than the average of the remaining 6, 51%. The reason for this has not been established. Examination of the urinary excretion showed that although the DTPA injections increased urinary excretion 10 fold, this difference between the treated and untreated dogs accounted for only 1.6% of the initial lung burden. Thus, for ^{144}Ce inhaled in this form, the lavage procedure was 28 times more effective in removing ^{144}Ce from the body than were the DTPA injections. The reduction in initial lung burden over a 56-day treatment period resulted in a decrease of the cumulative radiation dose to the lung, at 90 days and infinity, to 53 and 57%, respectively, of that found for the untreated dogs. No significant clinical changes due to treatment were observed in these animals. All of the dogs in this study were alive at 90 days post-exposure and are now under observation in the colony. (auth)

Plants

Refer also to abstracts 9763 and 10197.

10051 INVESTIGATIONS ON THE TRANSLOCATION OF ^{45}Ca IN APPLE TREES. I. Transport and Distribution in Relation to Time of Uptake. Wieneke, J.; Fuehr, F. (Kernforschungsanlage, Juelich, Ger.). Gartenbauwissenschaft; 38: No. 2, 91-108(1973). (In German).

On fruit-bearing apple trees ('Cox's Orange Pippin'/M9) in pot-sandculture under outdoor conditions the translocation of ^{45}Ca was investigated in relation to time of root uptake. The labeling was carried out: (1) immediately after dormancy till the end of blossoming, (2) during the early development of the fruit, and (3) after shoot growth had ceased. Radioactive Ca was already found in the inflorescences several days before full bloom. As the trees developed further the Ca translocation into all parts of the crown increased. At first the young fruit acted as a strong sink although—based on the weight—more Ca was transported into the leaf. In August (ca. 14 weeks after bloom) however, the Ca translocation into all the upper parts of the tree was much reduced although the trees had the highest water consumption in this month (twice as much as in June). Only a negligible amount of Ca was transported to the fruit. However, in plant organs with tissue still meristematic, as new flower and leaf buds, the Ca deposit was relatively high. In the leaf, Ca was mostly retained in the petiole and veins. There was no preferential Ca deposit in the various leaves of the seasonal shoots. In contrast, in the first labeling experiments Ca was found to move preferentially into the young leaves of growing shoots. The results demonstrate that besides transpiration the different growth stages of the plant organs during the season have an important influence on Ca distribution in apple trees. Also in these experiments a gradient of Ca was observed from the lower to the upper parts of the tree. (GE)

10052 RESIDUES IN CEREALS EXPOSED TO HYDROGEN PHOSPHIDE. Fowler, K. S.; Disney, R. W. (Ministry of Agriculture, Bucks, Eng.). pp 21-23 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

A study of ^{32}P residues in wheat fumigated with ^{32}P-phosphine was made. No radioactivity was exchanged between these residues and unlabelled phosphine to which the grain was subsequently exposed. Since exchange would occur in both directions it is concluded that ^{32}P residues cannot be produced by phosphorus exchange between the labelled fumigant and natural phosphorus compounds in the grain. The amount of phosphine that could be liberated from treated grain on heating with sulphuric acid or in a dry state amounted to less than 1% of the residues present. Residual phosphorus, of which 70 to 80% was extractable by aqueous media, was not significantly associated with phytin or phospholipids. (auth)

10053 MEASUREMENT OF UPTAKE OF CHELATED AND UNCHELATED Ca AND Sr FROM SOLUTION CULTURE. Elgawhary, S. M.; Barber, S. A. (Purdue Univ., Lafayette, IN). Contract AT(11-1)-1495. Plant Soil; 39: 581-590(1973). (COO-1495-19).

The uptake of Ca and Sr by three-week old tomato (Lycopersicon esculentum) plants from solutions containing Ca^{2+} and Sr^{2+}, and chelated Ca and Sr (CaL and SrL) was measured over a two-day period. The solution was double-labelled with ^{45}Ca and ^{85}Sr. Two chelates, EDTA (ethylenediaminetetraacetic acid) and DTPA (diethylenetriaminepentaacetic acid) were used at five chelate-cation ratios. When the Ca and Sr content of the solution was held constant, addition of chelate reduced uptake. The reduction was greater with EDTA than with DTPA. The Ca/Sr ratio of uptake

was used to measure the proportion of uptake as the chelated and unchelated species. The Ca^{2+}/Sr^{2+} ratio was different from the CaL/SrL ratio in solution because of the different equilibrium reactions of Ca and Sr with L. Direct uptake of the CaL and SrL was indicated. In solutions where Ca^{2+} = CaL, uptake of CaEDTA was 0.47 of uptake of Ca^{2+} and uptake of CaDTPA was 0.95 of uptake of Ca^{2+}. (auth)

10054 TRITIUM UPTAKE AND LOSS IN GRASS VEGETATION WHICH HAS BEEN EXPOSED TO AN ATMOSPHERIC SOURCE OF TRITIATED WATER. Kline, J. R.; Stewart, M. L. (Argonne National Lab., IL). Health Phys.; 26: No. 6, 567-575(Jun 1974).

Rates of uptake and loss of tritiated water (HTO) were measured in grass vegetation in the field after the plants had been exposed to an atmosphere containing HTO. Uptake of HTO from the atmosphere by leaves required 66 min to achieve 50% equilibrium activity while stems required 1970 min. Loss of HTO from leaves and stems during daylight however took place at rapid and comparable rates. The half time for loss in stems was 25 min while in leaves it was 35 min. Delabeling of contaminated leaves and stems in darkness took place at much reduced rates. The half time for delabeling of leaves in the dark was 400 min while for stems it was 2180 min. Rapid labeling and delabeling of plant tissue after exposure from the atmosphere takes place through leaf stomata and by direct transfer through the epidermis. Loss of HTO from plants is primarily dependent on transpiration. In the event of accidental HTO release to the atmosphere near the ground rapid contamination of vegetation could be expected. When the atmospheric source is dissipated, rapid decontamination could also be expected during periods of normal plant transpiration but not at night or other times when transpiration flow is not taking place. (auth)

10055 RADIOCESIUM RETENTION IN TOMATO PLANTS (LYCOPERSICUM ESCULENTUM) AS A FUNCTION OF THE STABLE CESIUM AND RADIOACTIVE ^{137}Cs CONCENTRATIONS OF THE NUTRIENT SOLUTIONS. Myttenaere, C.; Guillot, P.; Mousny, J. M. (EURATOM, Ispra, Italy). Radiat. Bot.; 14: No. 1, 29-36(Apr 1974).

The absorption of radioactive cesium chlorides ($^{137}CsCl$ and $^{134}CsCl$) and that of stable cesium chloride (CsCl) by tomato plants grown in nutrient solutions was compared for different concentrations of stable and radioactive cesium chlorides in solutions. The influence of these cesium concentrations was studied by multiparameter variance analysis of various experimental results. Plant weights: after 3 months growth in the solutions, there was no toxicity due to stable cesium, nor radiotoxicity due to radiocesiums. The ^{137}Cs concentration factor in plant organs was increased by addition of stable cesium to the nutrient solution in a way depending on the radioactive cesium concentration in the solution. The stable cesium concentration factor in plant organs was different from the radiocesium concentration factor: differences up to 50% were measured depending on the radiocesium concentrations in the solutions. The ratio of the two radiocesiums $^{137}Cs/^{134}Cs$ in plant organs was not constant and differed from the radiocesiums ratio in the nutrient solutions in a way that depended on the radioactive concentration in the solution. The results are discussed and the possibility of a different biological behavior of stable and radioactive cesium chlorides, according to their relative concentrations, is considered. (auth)

Microorganisms

Refer also to abstract 10201.

10056 INFLUENCE OF POTASSIUM ON THE REMOVAL OF ^{137}Cs BY LIVE CHLORELLA FROM LOW LEVEL RADIOACTIVE WASTES. Plato, P.; Denovan, J. T. (Univ. of Michigan, Ann Arbor). Radiat. Bot.; 14: No. 1, 37-41(Apr 1974).

The objective of this study was to determine the concentration of stable potassium that must be present in a radioactive waste solution to maximize the uptake of radiocesium by algae without a substantial reduction in algal growth. Laboratory cultures of Chlorella pyrenoidosa were grown under continuous culture conditions, and the accumulation of ^{137}Cs by the algae was measured. Potassium ion concentrations below 15 mg/l reduced the growth of C. pyrenoidosa, but increased the accumulation multiples for ^{137}Cs. The removal efficiencies, representing the combined effects of algal growth and accumulation multiples, obtained for ^{137}Cs ranged between 88 and 83% for potassium concentrations between 2 and 15 mg/l but were reduced to less than 20% when the potassium ion concentration was greater than 15 mg/l or less than 2 mg/l. (auth)

10057 PHYSICAL AND CHEMICAL STUDIES OF CYTOSINE-5-^{3}H DECAY AND CYTOSINE-6-^{3}H DECAY OCCURRING IN BACTERIAL DNA. Krasin, F. L. University Park, PA; Pennsylvania State Univ. (1973). 77p. University Microfilms Order No. 74-4257.

Thesis (Ph. D.).

Studies were undertaken to determine the chemical product of tritium decays from cytosine-5-^{3}H-2-^{14}C following the incorporation of the labelled molecules into bacterial DNA. The labelled DNA was extracted, purified, and stored in aqueous solution at −196°C to accumulate radioactive decays. Periodically samples were thawed, acid hydrolyzed, lyophilized, spotted onto a thin layer chromatogram and developed in two dimensions. Separated radioactive spots were visualized by autoradiography. One spot which co-chromatographed with uracil increased in ^{14}C radioactivity in proportion to accumulated number of tritium decays. 0.28 picomoles of this decay product was formed per picomole of tritium decays. It appears that former studies which showed that cytosine-5-^{3}H decays resulted in mutations mediated by C → T genetic coding changes were caused by the production of a uracil residue, or an intermediate molecule, which codes as T and was converted to uracil in the present experiments by acid hydrolysis. In vitro studies undertaken to determine if there were transmutation effects following tritium decay related to single strand breaks showed that decays from DNA-incorporated cytosine-6-^{3}H produced strand breaks four times as efficiently as those originating from cytosine-5-^{3}H. The lethality per decay for thymidine-6-^{3}H and for thymidine-methyl-^{3}H was the same in P3478, a polymerase deficient mutant of E. coli, and the parent strain, W3110. This result suggested that the extra single strand breaks produced from tritium decay on the 6 position of pyrimidines were efficiently repaired. (Diss. Abstr. Int., B)

New Tracer Techniques

Refer also to abstracts 9029, 9096, 9588, 9802, 9811, 10042, 10052, 10514, and 12135.

10058 (CNAEM-R-108) RECENT DEVELOPMENTS IN RADIOPHARMACEUTICALS. Tubis, M. (Cekmece Nuclear Research Center, Istanbul (Turkey)). 1973. 12p. Dep. NTIS (US Sales Only) $4.00.

Desirable characteristics of radiopharmaceuticals for assay of the function or structural breakdown of organs or for visualization of the presence of space-occupying lesions, such as an abscess or neoplasm, in tissues are reviewed. Research aimed at the development of new radiopharmaceuticals for specific diagnostic uses is discussed. Examples of new radiopharmaceuticals cited include: ^{99m}Tc-penicillamine for gall bladder visualization; ^{99m}Tc-penicillamine-acetazolamide complex for kidney imaging for the diagnosis of carcinoma, hyperplasia, or hydronephrosis; ^{113m}In-sulfide macroaggregates for lung perfusion scanning; ^{131}I- and ^{99m}Tc-labeled metronidazoles for amebic hepatic abscess imaging; and ^{99m}Tc-phosphates for bone scanning. Methods of chemical preparation and fast sterility testing are discussed briefly. (CH)

10059 (COO-3399-4) DEVELOPMENT OF SCAN ANALYSIS TECHNIQUES EMPLOYING A SMALL COMPUTER. Progress Report, August 1, 1973–July 31, 1974. Kuhl, D. E. (Pennsylvania Univ., Philadelphia (USA). Dept. of Radiology). 1974. Contract AT(11-1)-3399. 7p. Dep. NTIS $4.00.

This project is concerned with developing new ways of gathering and reconstructing emission data from patients who have been administered radioactive tracers in order to introduce and extend atraumatic imaging studies which will yield regional function data localized in three-dimensions. During the current project year we have accomplished the following: developed the CATC reconstruction technique which has advantages in accuracy and real time processing display, largely completed the Mark IV Transverse Section Imaging System, and applied quantitative section imaging following intravenous injection of ^{99m}Tc-erythrocytes to determine absolute values of local cerebral blood volume in animals and patients. (auth)

10060 (EUR-5123) THIN LAYER AND GAS-CHROMATOGRAPHIC ANALYSIS OF ALVEOLAR LIPIDS IN SILICOTIC RATS. Batti, R.; Arnoux, B.; Lamy, G.; Masse, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Apr 1974. 18p. Dep. NTIS (US Sales Only) $4.00. EUR B.Fr. 40.

The incorporation of ^{14}C Acetate into alveolar lipids has been studied in normal and silicotic rats. The surfactant was obtained by endobronchial saline lavage and the lipids were quantitated by thin-layer and gas-chromatography. The rate of incorporation of ^{14}C Acetate in comparison to control rats decreased in silicotic rats in spite of a high deposit of lipids in the alveoli. (auth)

10061 (IAEA-R-633-F) STUDIES OF THE CORONARY CIRCULATION WITH Rb-86 IN PATIENTS WITH CHRONIC CHAGAS' DISEASE AND OTHER CARDIOPATHIES. Final

Report, 1 July 1968–31 March 1972. Kuschnir, E. (International Atomic Energy Agency, Vienna (Austria)). 1972. 17p. (In Spanish). INIS.

A double radioactive tracer technique with ^{86}Rb and ^{131}I-labeled human serum albumin was employed for scintiscanning to study changes in coronary blood flow and cardiac output in the evolution of Chagas' disease and to evaluate the effects of drugs used in its management. Parallel studies were carried out in patients with coronary disease. Serial measurements of the two parameters were made on normal patients, patients with coronary disease and patients with Chagas' disease classified according to stage of development of the disease under four conditions (basal, after exercise, after strophanthin administration, and again after exercise). Further serial measurements were made on the same groups of patients under three conditions (basal, after a single sublingual dose of isosorbide dinitrate, and after prolonged daily oral dosage with dipyridamol). Results indicate that cardiac output, coronary blood flow, cardiac reserve, and coronary reserve are progressively diminished in both Chagas' disease and coronary disease, but that in the former, unlike the latter, there is a partial maintenance of coronary reserve. Single doses of isosorbide dinitrate had no significant effect on the measured parameters in any of the groups studied but prolonged dosage with dipyridamol significantly increased coronary blood flow and, to a lesser extent, cardiac output in patients with Chagas' disease, as in patients with coronary disease. The use of dipyridamol in the management of patients with Chagas' disease thus appears justified as a means of limiting myocardial fibrosis secondary to hypoxia and inflammation. (INIS)

10062 (IAEA-R-669-F) APPLICATIONS OF RADIOIMMUNOASSAY TECHNIQUES IN STUDIES OF THE PATHOGENESIS OF DIABETES MELLITUS. Final Report, 1 March 1969–30 November 1971. Penchev, I. (International Atomic Energy Agency, Vienna (Austria)). 1972. 28p. INIS.

In an attempt to detect early signs of diabetes and to enlarge knowledge on the pathogenesis of the disease, extensive laboratory studies were undertaken covering groups of normals, of relatives of diabetics, of diabetic patients, and of individuals showing abnormalities in their carbohydrate metabolism. The last group was selected by mass screening for postprandial glycosuria after a standard meal by means of paper-strip tests and was performed on 10,000 industrial workers. Many of those presenting glycosuria (6.6% of the total) were further examined by means of oral and intravenous glucose tolerance test (OGTT and IVGTT). Other laboratory examinations were also performed including anti-insulin antibody determination by gel electrophoresis and plasma immuno-reactive insulin (IRI) determination by radioimmunoassay. Circulating anti-insulin antibodies were found in 66% of the insulin-treated diabetic patients and in 15% of diabetics without previous insulin treatment. In relatives of diabetics, a decreased insulin secretion appears to be compensated and not to influence the glucose tolerance test curves. An almost normal insulin secretion was found in persons with postprandial glycosuria showing a lower glucose tolerance. The observation of circulating anti-insulin antibodies in a significant proportion of diabetic subjects not previously treated with insulin strongly suggests the participation of an autoimmune mechanism in some forms of the disease and pointed to the need for further investigation in this area. (INIS)

10063 (IAEA-R-672-F) APPLICATIONS OF RADIOIMMUNOASSAY TECHNIQUES IN GROWTH HORMONE STUDIES IN UNDERNOURISHED CHILDREN AND ADOLESCENTS WITH RETARDED GROWTH. Final Report, 15 December 1968–31 August 1972. Litvak, J. (International Atomic Energy Agency, Vienna (Austria)). Aug 1972. vp. INIS.

Growth hormone secretion was measured under insulin or arginine stimulation in normal children and adolescents, and in eleven children with short stature with a record of present or past malnutrition. As a group, the patients had higher mean STH values than the controls, although the difference was not statistically significant. Other parameters of growth activity like urinary hydroxyproline excretion and serum phosphate were also normal. Other studies including thyroid radioiodine uptake and urinary response of 17 hydroxycorticosteroids and 17 ketosteroids to the administration of metyrapone and ACTH were within the acceptable normal limits. Pituitary function and specifically HGH secretion in such patients are concluded to be normal or reverted to normal if there had been any decrease in function in earlier stages. (INIS)

10064 (IAEA-R-710-F) ISOTOPE STUDIES OF EXTRATHYROIDAL IODIDE TRANSFER MECHANISMS. Part of a Co-ordinated Programme on Trace Element Metabolism and Disease in Animals of Agricultural Importance. Final Report, 1 September 1968–29 February 1972. Lengemann, F. W. (International Atomic Energy Agency, Vienna (Austria)). Jun 1972. vp. INIS.

Iodine, in the form of iodate and iodide, was used as a reference substance to develop a model and work out techniques which will allow quantitative studies on the movement of minerals across the secretory epithelium in the mammary gland of cows, goats, and guinea-pigs. It was found that iodate was less rapidly absorbed from the intestines but behaved metabolically essentially identical with iodide. This is of significance for animal nutrition as well as for radiological health considerations. To allow compartmental analyses in kinetic mammary gland studies, accurate methods for the determination of the total milk contained in the udder and of the fractional composition of the mammary gland were established. Milk volumes were determined by isotope dilution using ^{141}Ce or ^{14}C-PEG as markers. Reliable and reproducible results were obtained when milk sampling was preceded by an oxytocin injection and gentle manipulation of the udder. In guinea-pigs a correction has to be made to account for non-uniform distribution of the label. Cerium-141 was found to be associated with milk proteins whereas ^{14}C-PEG distributed in the aqueous phase. By a combination of histological, photographical, and isotope dilution techniques, it was found that the mammary gland of guinea-pigs consisted of 55.7% secretory tissue, 39.8% supportive tissue, and 4.5% blood plasma if calculated on a milk-free basis, with a remarkably low degree of variation between animals and glands. (INIS)

10065 (IAEA-R-789-F) APPLICATION OF RADIOISOTOPE TECHNIQUES IN STUDIES OF ABNORMALITIES IN MALE SEXUAL DEVELOPMENT. Final Report, 1 September 1969–30 September 1972. Rivarola, M. A. (International Atomic Energy Agency, Vienna (Austria)). Nov 1972. 7p. INIS.

In unilateral and bilateral cryptorchidism in prepubertal children, plasma testosterone concentration increased from a mean of 25 ± 24 ng/100 ml to 431 ± 96 and 329 ± 172 respectively after five days of daily injections of human chorionic gonadotropin (800 to 5000 U/day). No changes were seen in bilateral anorchia. Children with male pseudo-hermaphroditism showed a definite though smaller response. Children with hypopituitarism had responses varying from none to normal. This group was further studied during prolonged administration of human chorionic gonadotropin (from 2 to 15 months). The same variable response was observed under this prolonged treatment. Whenever testicular tissue is present, a response to gonadotropin can always be detected in sexually immature subjects with the exception of some cases of hypopituitarism. Aldosterone secretion rate was found to be higher than normal in children with the simple virilizing form of congenital adrenal hyperplasia, particularly in cases without previous treatment. The isolated seminiferous tubules of mature rats converted 24% of testosterone-^{14}C into 5α–androstan–3α, 17β–diol–^{14}C after 3 hours of incubation, while the main metabolite in the interstitial tissue was androst-4-en-3, 17 dione. The seminiferous tubules of 20-day old rats were able to transform 60% of the precursor into androstandiol. In material prepared from rats less than 10 days of age, no metabolic activity was present but could be observed in seminiferous tubules from animals of 12 days of age, a maximum being observed when from those of 20 days and decreasing in material from older animals. The highest activity was observed at the meiotic stage of the development of the germinal epithelium. (INIS)

10066 (IAEA-R-858-F) STUDIES OF A RADIOACTIVE GEL DIFFUSION TECHNIQUE AND ITS APPLICATION TO IMMUNOLOGICAL STUDIES ON AFRICAN POPULATIONS. Final Report, 1 January 1970–31 May 1972. Rowe, D. S. (International Atomic Energy Agency, Vienna (Austria)). Jan 1973. 9p. INIS.

Work carried out under this contract was mainly directed towards the refinement of the radioactive single radial diffusion method (RSRD) for the measurement of immunoglobulins and other protein antigens, originally described by the contractor in 1969. Various modifications aimed at increasing the sensitivity of the method were introduced; these led to improved reliability and slightly increased sensitivity, making the method suitable for measurements at levels down to about 100 ng/ml. A simplified washing technique reducing the time required for the two-stage form of the method from 7 to 5 days was introduced. A single-stage form requiring only 3 days was also developed and found satisfactory. The use of a direct counting technique instead of autoradiography for radioactivity measurements reduced the time required still further, to 2 days. Each of these modifications had its particular advantages and disadvantages. A further modification of the method for the measurement of protein secreted by single cells was developed. (INIS)

10067 (IAEA-R-860-F) STUDIES OF A RADIOPROTECTIVE GEL DIFFUSION TECHNIQUE AND ITS APPLICATION TO IM-

MUNOLOGY. Final Report, 1 January 1970–31 December 1972. Houba, V. (International Atomic Energy Agency, Vienna (Austria)). Jan 1973. 7p. INIS.

The radioactive single radial diffusion method (RSRD) of Rowe was used for the estimation of serum immunoglobulin E (IgE) in various groups of African and European subjects. These comprised 271 Nigerian blood donors, 35 Nigerians with vesical schistosomiasis, 30 Nigerians with onchocerciasis or loiasis, 53 Tanzanians from malarial and 46 from non-malarial regions, 30 Nigerians with various allergies, 39 Ghanaian children with asthma and 24 matched controls, 35 Nigerian cocoa bean workers and 72 expatriates from Europe or North America living in Nigeria. The mean level of serum IgE in the various groups of African subjects studied ranged from 1445 to 4194 units/ml. In expatriates living in Nigeria it was 438 units/ml. These results confirm the higher levels of serum IgE in African subjects previously reported. The reasons for this finding, which appear complex, are discussed. (INIS)

10068 (IAEA-R-1047-F) MALATHION, DIAZINON, AND CARBARYL RESIDUES ON SOME VEGETABLES. Part of a Coordinated Programme on the Fate and Significance of Foreign Substances in Food. Final Report, 1 November 1971–31 October 1972. Sun, C. N. (International Atomic Energy Agency, Vienna (Austria)). Dec 1972. 25p. INIS.

The fate of ^{14}C-labeled malathion, diazinon, and carbaryl was studied on vegetables (pak-choi, pigweed, spinach, and leek) grown and processed according to Taiwan conditions. Residues (including metabolites) were determined from two dosages (0.5 and 1.0 kg/ha), at various intervals between application (0, 1, 2, 4, and 7 days) and harvest and under different regimes of storage (room temperature and 5°C) and washing (water and detergent). Dissipation curves showed an initial period of rapid disappearance on all four vegetables followed by a period of low rate of disappearance. However, it was evident that the nature of the disappearance behavior of pesticides varies according to the kind of pesticides and the type of plant materials. Malathion disappeared from the vegetables at the fastest rate, while carbaryl had the longest persistence on these vegetables, with diazinon in between. However, on the basis of a preharvest waiting period of 10 to 14 days, the carbaryl residues left on these plants would be low enough as not to cause any alarm. Spinach had the fastest diazinon dissipation rate, while leek had the fastest carbaryl dissipation rate. Diazoxon was the only metabolite detected on the vegetables treated with diazinon. No metabolites of malathion or carbaryl was found. The rate of application generally affected the rate of disappearance. The higher the rate of initial application, the lower the rate of disappearance of the insecticides from the vegetables. Washing with water or detergent both reduced the residual insecticides on the vegetables with malathion being the easiest to remove. Storage of the fresh vegetables at room temperature for 12 hours caused about 20% reduction of residues for malathion, about 10% for diazinon and carbaryl. Storage at 5°C made more malathion disappear from the vegetables than diazinon and carbaryl. (INIS)

10069 (INIS-mf-1308) SKELETAL SCINTIPHOTOGRAPHY UTILIZING STRONTIUM-87m. Ruijs, J. H. J. (Rijksuniversiteit Utrecht (Netherlands)). 1973. 123p. (In Dutch). INIS.

Because of its relatively low radiation dose, strontium-87m is frequently used for bone scanning. The estimated body dose of this radionuclide is 23 millirads per administered mCi of strontium. Especially in benign bone diseases scanning with strontium-87m is of great value. The reliability of the scans, which were all made with a gamma camera, is estimated to be 85%. (INIS)

10070 (LA-5535-C, pp 5-21) NUCLEAR MEDICINE: PRESENT STATE AND ITS FUTURE. Saenger, E. L. (Univ. of Cincinnati). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

General principles of nuclear medicine are reviewed. Some specific examples of accelerator-produced radioisotopes (^{123}I, ^{129}Cs, ^{43}K, ^{127}Xe, ^{128m}Ba, ^{151}Dy, ^{52}Fe, ^{111}In, and ^{67}Ga) are discussed and their potentialities for use as scanning agents are compared with radionuclides in current use. It is concluded that there is a need for large scale production of spallation radionuclides for medical needs on a service as well as on a research and development basis. In order to fulfill these needs, the facilities of private industry, AEC and other Federal facilities need to be combined in a National Accelerator Nuclide Network (NANN), which must be sufficiently flexible and well-coordinated to assure a steady supply of radionuclides on a priority basis equal to that of other priorities in the absence of a national emergency. (CH)

10071 (LA-5535-C, pp 47-62) ROLE OF THE BRH IN THE PROMOTION OF LOW-RADIATION-DOSE RADIOPHARMACEUTICALS. Sodd, V. J. (Bureau of Radiological Health, Cincinnati). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

The Bureau of Radiological Health (BRH) of the Food and Drug Administration conducts a national program designed to reduce the exposure of patients, workers, and others to unproductive x-rays, radiopharmaceuticals, and radioactive materials. One way of reducing radiation exposure to patients is to use radionuclides which have more desirable physical and biological characteristics than those presently in use. In 1967, the NML has directed its accelerator and clinical research to promote the production and widespread distribution of these desirable radionuclides. Results are reported from an investigation to determine the feasibility of producing ^{123}I in quantities necessary for nationwide use at a reasonable cost. Clinical comparisons were also made of cyclotron-produced ^{123}I with ^{131}I for the study of thyroid function, and ^{129}Cs for heart scanning for the diagnosis of myocardial infarction. (CH)

10072 (LA-5535-C, pp 74-92) NUCLEAR BIOLOGY MICROSCOPE. Marcus, C. S. (Univ. of California, Los Angeles); Ewins, J. H.; Frasher, W. G. Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

The feasibility of mounting semiconductor detectors on a microscope to perform direct dynamic radioisotope experiments on small groups of cells and single cells is discussed. A list of short-lived radionuclides that emit β^- or β^+ particles which are required for this concept is given. (WHK)

10073 (LA-5535-C, pp 178-183) MUONIC X RAYS FROM SAMPLES OF HEALTHY AND DISEASED ANIMALS. Springer, K.; Pfeiffer, H. J.; Daniels, H. (Univ., Munich). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

Muonic x-ray spectra from tissue samples of healthy animals were measured. Also normal and pathological samples of liver and muscle tissue were examined and compared. Negative muons were stopped in the samples and the x rays were detected with a Ge(Li) detector having a resolution (FWHM) of 1.2 keV at 134 keV. The elements carbon, nitrogen, oxygen, and calcium can be readily identified. The results are given in the form of ratios of intensities or ratios of intensity ratios. (MCG)

10074 (LF-tr-91) METHODOLOGY OF THE AUTORADIOGRAPHIC DETECTION PROCESS. Graul, E. H.; Hundeshagen, H. Translated from Z. Naturforsch., 12b: 534-536(1957). 8p. Dep. NTIS $4.00.

Techniques for the preparation of autoradiographs of animal tissues following the administration of radioisotopes are described. (CH)

10075 (STI/PUB-363) ISOTOPE TRACER STUDIES OF CHEMICAL RESIDUES IN FOOD AND THE AGRICULTURAL ENVIRONMENT. Panel Proceedings Series. Proceedings Held at Ispra, Italy, October 30–November 10, 1972. (International Atomic Energy Agency, Vienna (Austria)). Feb 1974. 161p. (CONF-7210116-). IAEA $7.50.

Sixteen of the nineteen papers presented were indexed separately. (LK)

For abstracts of individual papers see: 9081, 9241, 10052, and 10194–10206.

10076 (TID-26570) METHODS FOR QUANTITATIVE ASSAY OF RADIOACTIVITY IN MAN: TOTAL BODY AND REGIONAL DISTRIBUTIONS. Watts, J. R. (Vanderbilt Univ., Nashville, Tenn. (USA)). Dec 1971. Contract AT(40-1)-2401. 300p. Dep. NTIS $18.00.

Thesis.

The Vanderbilt University Hospital whole-body counter was changed to a scanning bed geometry in order to increase its versatility as a clinical instrument. After evaluation of the counter, this research developed a method for measuring the total body and regional distributions of radioactivity. The adequacy of both methods was demonstrated with human volunteers. Evaluation of the whole body counter facility determined its applicability for clinical investigation as the background was acceptably low and the sensitivity adequate for radioactivity levels anticipated. The

counter was calibrated for total body measurement of ^{42}K, ^{131}I, and ^{57}Co. The external measurement of radionuclides in subsections of the body is complicated by several factors: variations in body thickness, size and location of the section of interest, and radioactivity in surrounding tissue. The general approach to measuring these factors was to obtain a two dimensional image of the emitted radiation by collecting collimated data as the scanner moves through a rectilinear raster pattern over the subject. The two types of collimators used, single hole tapered bore (SHTB) and focused, demonstrated the practical limit of poor resolution and good sensitivity, and good resolution but poor efficiency, respectively. The scanning bed geometry whole body counter has demonstrated usefulness as a clinical instrument. The methods developed for radioactivity measurements are believed general enough so that only basic calibration is necessary for use with other radionuclides. The success of the measurement of radioactivity in body subsections is particularly gratifying in that the same method gives adequate results with two vastly different collimators, indicating that this approach is general for this range of collimators in this particular geometry. (ERB)

10077 (TID-26572) RADIOISOTOPE STUDIES UTILIZING A LOW LEVEL WHOLE-BODY COUNTER AND CLINICAL APPLICATIONS OF ACTIVATION ANALYSIS. Progress Report. Brill, A. B. (Vanderbilt Univ., Nashville, Tenn. (USA)). 30 Apr 1974. Contract AT(40-1)-2401. 120p. Dep. NTIS $9.00.

Developments in software and hardware associated with dosimetry and tracer kinetics studies in nuclear medicine are discussed. Specific radiopharmaceuticals under investigation include: ^{111}In–DTPA; ^{169}Yb–DTPA; ^{99m}Tc bone seeking agents; ^{131}I-cholesterol and ^{206}Bi. Other investigations involving applications of radiopharmaceuticals include: calcium kinetics; osteoporosis and Paget's disease; osteogenesis imperfecta; massive obesity; monitoring of ^{137}Cs levels in man; and assessment of radiocontaminants in ^{99m}Tc eluates. Studies of clinical applications of activation analysis include: californium feasibility study (as neutron source for activation analysis) and tissue levels of trace elements in ischemic heart disease. (ERB)

10078 (UCLA-12-964) RADIONUCLIDE EVALUATION OF RENAL TRANSPLANT STATUS. Hayes, M.; Moore, T. C.; Taplin, G. V. (California Univ., Los Angeles (USA). Lab. of Nuclear Medicine and Radiation Biology). 1973. Contract AT(04-1)-GEN-12. 13p. Dep. NTIS $4.00.

Quantitated sequential renal scintiphotos performed with ^{131}I-hippurate were more sensitive than serum chemistries and clinical signs as indicators of renal transplant status, and were often successful in predicting acute rejection crises. The most useful indices depending on the general post-transplant level of function were the kidney/background ratio at 20 minutes post-injection, the minimum bladder entry time post-injection, and the bladder/kidney ratio. In the few cases where it was necessary to differentiate tubular necrosis from hyperacute rejection, intravenous radionuclide angiography was helpful. (auth)

10079 MORE SENSITIVE QUANTITATION OF LOW LEVEL SERUM IgE AND α_1-FETOPROTEIN BY SINGLE RADIAL IMMUNODIFFUSION USING RADIOIODINE LABELED IgE OR α_1-FETOPROTEIN AS MARKER. Shibata, K.; Terano, Y.; Ichihashi, H. (Hoechst Japan Ltd., Tokyo). Z. Immunitaetsforsch., Exp. Klin. Immunol.; 146: No. 1, 71-80(1973).

A description is given of a new simple method for quantitation of low level serum IgE and α_1-fetoprotein (α_1F) by the single radial immunodiffusion process with a tracer level of radioiodine-labeled IgE (tracer IgE*) or α_1F (tracer α_1F^*) being applied in an immunoreaction well prior to application of patient serum or standard IgE serum (PS) or α_1F in the same well. In a radioautogram made after the immunodiffusion, the applied tracer IgE* or α_1F^* was observed as ring or round area, the diameter of which is governed by the principle of Mancini et al. on antigen quantitation with the single radial immunodiffusion method. The limit of this quantitation was 50 U/ml serum in IgE and 54 ng/ml in α_1F. And the actual assay results of IgE concentrations of patients who visited hospital with suspicion of Schistosomiasis Japonica were compared with the conventional indirect method using the labeled 2nd antibody. (auth)

10080 RADIATION BIOLOGY IN PEDIATRIC NUCLEAR MEDICINE. Saenger, E. L.; Kereiakes, J. G. (Univ. of Cincinnati). pp 1-22 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Nuclear medicine can provide the pediatrician with valuable clinical information about the sick child that is uniquely available with this technique. These methods can be considered entirely safe with the employment of appropriate radiopharmaceuticals, equipment, highly qualified personnel and, above all, the selection of proper indications by the physician. The use of the whole-body counter for studies of pediatric problems and the development of the dual-crystal system for detection of radioiodine in the thyroid gland are examples of this approach. Methods to minimize radiation doses in the young are discussed. It is pointed out that average whole-body and organ doses calculated for standard man do not necessarily apply to children because of differences in metabolism and size of organs. If the effects of a given radiopharmaceutical with the same effective half-life are compared in a child and in standard man, then the difference in dose per unit of activity for β particles, electrons, and γ of energy less than 11 keV is simply a function of the ratio of organ mass of a child of a given age versus standard man. Gamma dose, however, requires special consideration, since the absorbed fraction depends on γ energy. (CH)

10081 PRACTICAL FACTORS IN RADIATION DOSE REDUCTION. Mitchell, T. G. (John Hopkins Univ., Baltimore). pp 22-34 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The factors involved in the determination of administered radiation dose in pediatric, nuclear medicine are discussed. It is shown that some nuclear medical procedures lead to very small absorbed doses, yet yield information of significance. Even so, the absorbed radiation dose may be reduced considerably in most instances by proper attention to maximizing the ratio of (target-nontarget) activity for all radiation detection systems used, increasing counting times, and in the case of in vivo quantitative studies, decreasing the distance between source and detectors whenever possible. In vivo function and scanning type studies represent the greatest potential areas for high administered radiation dose to the child. Great advances may be made in reducing absorbed radiation dose by taking advantage of the time-independent nature of data collection afforded by γ cameras which permit the use of ultra-short-lived radionuclides and multiple, repetitive, short-term counting sessions. A conversion to ^{99m}Tc-labeled radiopharmaceuticals or other short-lived high photon yield radionuclides affords the greatest opportunity for dose reduction. Because of their high efficacy, they allow repetitive studies to be made with little increase in overall cumulative radiation dose. (auth)

10082 INSTRUMENTATION IN PEDIATRIC NUCLEAR MEDICINE. Harris, C. G.; Goodrich, J. K.; Workman, J. B. (Duke Univ., Durham, NC). pp 59-72 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

While rectilinear scanners will continue to be used with the pediatric patient, the positioning flexibility, sensitivity, resolution, and retrieval capabilities now obtainable with the scintillation γ camera make it of greater value in pediatric nuclear medicine studies. Additionally, the scintillation camera can be used to advantage for studies formerly carried out with external probe instrumentation. (auth)

10083 USE OF THE PINHOLE COLLIMATOR IN PEDIATRICS. Lomas, F. (Canberra Hospital). pp 72-78 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The pinhole collimator is an inexpensive option available with many scintillation γ cameras. It can be of value in many situations in organ imaging where improved resolution of small organs or lesions is required as in pediatric scintiscanning. (auth)

10084 RADIOPHARMACEUTICALS IN PEDIATRICS. Bell, E. G.; McAfee, J. G.; Subramanian, G. (State of New York, Syracuse). pp 84-94 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Information known about the biological localization of trace elements and the mechanisms involved in the localization of labeled compounds in the body is reviewed. While it is unlikely that the older child will possess altered mechanisms for handling these radioactive compounds, it is anticipated that the very young child with his known immature renal and hepatic systems will show altered responses. The preparation and precautions necessary for the use of common radiopharmaceuticals are discussed as well as a rational approach to calculating the dose for the child. (auth)

10085 SEDATION, INJECTION, AND HANDLING TECHNIQUES IN PEDIATRICS NUCLEAR MEDICINE. Conway, J. J. (Northwestern Univ., Chicago). pp 95-102 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

A standardized sedation mixture of meperidine hydrochloride, promethazine hydrochloride, and chlorpromazine (Demerol, Phenergan, Thorazine) administered on a weight basis is presented as a satisfactory agent for sedating children during radionuclide imaging studies. An injection technique for children utilizing a scalp vein needle connected to the radionuclide and saline syringes via a three-way stopcock is also described. The veins on the dorsum of the hand and foot are considered ideal sites

for the injection. Positioning is accomplished preferably by moving the detector around the patient. The versatility of positioning with the γ camera is advantageous for use with infants and children. (CH)

10086 VALUE OF BRAIN SCANS IN PEDIATRICS. Mahin, D. (Anne Arundel General Hospital, Annapolis, MD); Wagner, H. N. Jr. pp 103-115 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Brain scanning is safe and highly useful in pediatric patients as a screening test for suspected intracranial disease and is helpful in follow-up studies. A review is presented of some reported features of brain scanning that are particularly important in the pediatric age group as they differ from studies in adults. (auth)

10087 BRAIN IMAGING IN PEDIATRICS. Conway, J. J.; Quinn, J. L. III. (Northwestern Univ., Chicago). pp 115-126 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Radionuclide brain imaging has many diverse and useful applications in the diagnosis and treatment of infants and children with neurologic disease. It is a safe and simple procedure and should be used as an integral part of the neurologic evaluation. Radionuclide brain imaging can no longer be considered strictly a screening test. In many instances, the clinical symptomatology and image abnormalities are characteristic enough to warrant therapeutic action. It is no longer of primary value to compare one modality of examination with another. Each examines the patient differently and therefore contributes in its own manner to the patient's welfare. Studies combining the patient's clinical history and physical findings should be designed to make optimum technical use of the procedure, and results should be correlated with other diagnostic studies in order to assure the most accurate diagnosis and to plan the most effective patient care. (auth)

10088 CEREBRAL EDEMA. Siegel, B. A. (Washington Univ., Saint Louis); Studer, R. K.; Potchen, E. J. pp 126-133 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Areas in which brain scanning is of greatest use in pediatric patients are discussed. First, in the exclusion of significant neurosurgical pathology, the brain scan is a useful screening procedure and may help direct and pace the subsequent neurological diagnostic procedures and therapeutic measures. Second, in the diagnosis, treatment, management, and follow-up of brain abscess, the brain scan is a technique of vital importance. Third, in the diagnosis of intraventricular tumors the brain scan may help in detecting such lesions when other means provide only nonspecific evidence of neurological disease. Last, the brain scan is of great use in the follow-up of patients who have incompletely excised tumors or who have lesions with a high possibility of recurrence. (auth)

10089 BRAIN SCAN IN PEDIATRIC NEUROSURGERY. Laws, E. R. Jr. (Mayo Medical School, Rochester, MN); Udvarhelyi, G. B. pp 133-143 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Areas of maximum value of brain scanning in pediatric neurosurgery include: exclusion of neurosurgical pathology; diagnosis and follow-up of brain abscess; diagnosis of intraventricular tumors; and postoperative evaluation. (CH)

10090 TECHNIQUE OF CEREBROSPINAL FLUID IMAGING IN PEDIATRICS. James, A. E. Jr.; Matthews, E. S.; Dorst, J. P. (John Hopkins Univ., Baltimore). pp 144-158 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Cerebrospinal fluid imaging has proved a useful diagnostic technique in children for evaluation of hydrocephalus, determination of patency of CSF diversionary shunts, detection of CSF fistulas, and assessment of abnormalities of CSF flow. Many different radiopharmaceuticals have been employed. A ^{99m}Tc-labeled radiopharmaceutical is recommended for shunt evaluation and CSF fistula detection. Both scintillation cameras and rectilinear scanners may be effectively utilized as imaging devices. However, the speed of imaging and versatility of the scintillation camera make it particularly suitable for use with children. (auth)

10091 CLINICAL APPLICATIONS OF CISTERNOGRAPHY IN PEDIATRICS. Harbert, J. C. (Georgetown Univ. Hospital, Washington, DC); McCullough, D. C.; DiChiro, G. pp 158-169 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Of the indications for radionuclide cisternography in infancy and childhood, the study of hydrocephalus is the most important. Hydrocephalus is caused by a block in the absorption of CSF that may be found at any site between the choroid plexus and the arachnoid villi. The block may be complete or partial, permanent or temporary, and the clinical application of cisternography in hydrocephalus consists of the identification of this block, an estimate of its effect on CSF dynamics, and an indication of its treatment. (CH)

10092 VALUE OF CEREBROSPINAL FLUID IMAGING IN PEDIATRICS. Ouvrier, R. A. (Royal Alexandra Hospital, Camperdown, Australia); Freeman, J. M.; McKhann, G. M. pp 170-179 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Radionuclide cisternographic procedures in 33 pediatric patients are reviewed in order to evaluate their clinical usefulness. The indications for such procedures mainly included suspected CSF fistulae, questions of shunt function, investigations of hydrocephalus, and suspicion of occult hydrocephalus. It was concluded that cisternography is a valuable technique for the detection of CSF leaks, especially when combined with isotope counts in the nasopharynx and ears. (CH)

10093 LUNG SCANNING IN PEDIATRICS. Jones, R. H.; Sabiston, D. C. Jr.; Goodrich, J. K. (Duke Univ., Durham, NC). pp 180-203 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Pulmonary perfusion and ventilation scanning using radioactive gases or radioactive particles provides an innocuous method for assessment of pulmonary function in children. The nature of pulmonary disease in children makes the most important use of lung scanning the serial quantitation of changes in function. Assessment of regional perfusion and ventilation aids the diagnosis, choice of management, determination of prognosis, and establishment of natural history of pulmonary diseases. Increased use of radionuclide regional lung function measurements promises to result in improved treatment of respiratory disease in childhood. (auth)

10094 EVALUATION OF CHEST MASSES AND PARENCHYMAL LUNG DISEASE WITH RADIONUCLIDE ANGIOGRAPHY IN PEDIATRICS. Conway, J. J. (Northwestern Univ., Chicago). pp 203-218 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Radionuclide angiography of the chest in children is a relatively innocuous technique which can rapidly provide useful diagnostic information for several conditions, including the evaluation of chest masses, preoperatively differentiating avascular from vascular lesions; postoperative differentiation of hematoma from atelectasis or pneumonia; documentation of displaced organs or vascular obstruction from neoplasm or thrombosis; illustration of the patency of surgically created cardiac shunts; rapid documentation of pericardial effusion and differentiation from pericarditis; and definition of congenital vascular abnormalities such as absence of the pulmonary artery and anomalous origin of the pulmonary artery from the aorta. As techniques, radiopharmaceuticals, and detection equipment improve, the use of radionuclide angiography for evaluating lesions of the chest in children will undoubtedly increase. (auth)

10095 RADIONUCLIDE ANGIOCARDIOGRAPHY IN PEDIATRICS. Strauss, H. W. (John Hopkins Medical Institutions, Baltimore); Wagner, H. N. Jr.; Wesselhoeft, H.; Hurley, P. J. pp 219-231 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Nuclear angiocardiography is a diagnostic procedure in which the course of a radionuclide is traced with a scintillation camera as it traverses the heart and great vessels following intravenous injection. Nuclear angiocardiography is an innocuous procedure, yet it yields sufficient data to answer specific clinical questions. It is particularly well suited to the evaluation of various congenital and acquired cardiac conditions in children. (CH)

10096 INTRACARDIAC SHUNTS. Treves, S. (Harvard Medical School, Boston); Maltz, D. L.; Adelstein, S. J. pp 231-246 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

A method of radionuclide angiocardiography for the detection and localization of intracardiac shunts is described. The γ scintillation camera and a digital videotape recording system with region of interest mode capability are used. Both scintigraphic display and time-activity curves are obtained. A critical factor for successful examination is the delivery of a compact bolus of radionuclide. A simple injector has been developed for this purpose. It is concluded that radionuclide angiocardiography offers a simple, effective, and relatively noninvasive method to detect intracardiac shunts in pediatric patients. (CH)

10097 USE OF NUCLEAR IMAGING EVALUATION OF ACQUIRED HEART DISEASE IN CHILDREN. Cooper, M. (Univ. of Maryland, Baltimore). pp 246-264 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Improvements in instrumentation and use of newer radiopharmaceuticals have increased the diagnostic value of nuclear medicine

studies of the central circulation. The radionuclide angiocardiogram combined with a blood-pool scan can aid in distinguishing congenital heart disease and acquired heart disease involving the pericardium and myocardium. Quantitative studies of flow through the right and left heart and assessment of left ventricular function are promising recent advances. Consideration should also be given to the possible use of myocardial scanning agents. At present the clinical utility of many of these methods remains to be established and there are limitations in applying the techniques to children. Their particular potential value appears to be in the screening diagnosis and follow-up of children with suspected or proven heart disease. (auth)

10098 PREOPERATIVE AND POSTOPERATIVE ASSESSMENT OF CONGENITAL HEART DISEASE. Haroutunian, L. M.; Neill, C. A.; Wagner, H. N. Jr.; White, R. I. (John Hopkins Medical Institutions, Baltimore). pp 265-276 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The correct interpretation of abnormal lung scans in pediatric patients with congenital heart disease, especially of a cyanotic type, is discussed. The number of possible causes of perfusion defects is quite large, ranging from congenital anomalies of pulmonary arterial branches to postoperative pulmonary thromboembolism, and it also includes perfusion differences and defects due to intervening palliative surgery. The circumstances in which either interpulmonary or segmental perfusion differences may be seen in patients with congenital heart disease are reviewed. (CH)

10099 IMAGING THE LIVER IN PEDIATRICS. Rosenthall, L. (McGill Univ., Montreal). pp 277-290 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Many facets of hepatic radionuclide imaging in pediatric patients are discussed. This is a relatively noninvasive method of obtaining information on size, position, integrity, and function of the organ. Of prime concern is possible radiation damage to the reproductive system. As yet there is no definite proof that a threshold dose of radiation damage exists and, therefore, it must be assumed that all radiation is deleterious until shown otherwise. The decision to obtain a radionuclide study is contingent on the usefulness of the information that might be gained. If the results can aid in the clinical management of the patient then the examination should be performed. Furthermore, the dose of radiopharmaceutical that is administered should not be reduced to the point of sacrificing image quality. Every effort should be made to employ those radionuclides which yield the least radiation absorbed dose. (CH)

10100 EVALUATION OF JAUNDICE. Odell, G. B.; Boitnott, J. K. (Johns Hopkins Medical Institutions, Baltimore). pp 290-298 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The value of radioisotope scanning of the liver and biliary tract for the differential diagnosis of congenital hepatitis of infectious origin and biliary atresia in infants is discussed. The causes of conjugated hyperbilirubinemia and the hemolytic disorders often associated with significant concentrations of conjugated bilirubin in the blood serum that result in the persistence of jaundice after the second week of life are discussed. (CH)

10101 ABDOMINAL IMAGING IN PEDIATRICS. Gilday, D. L. (Univ. of Toronto); Rosenthall, L.; Duszynski, D. O.; James, A. E. Jr. pp 298-307 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The combination of abdominal pain and rectal bleeding of infants poses a serious diagnostic problem. Two frequently encountered entities involved are congenital Meckel's diverticulum and intussuseption of the intestine. The diagnostic value of abdominal scans after the intravenous injection of ^{99m}Tc-pertechnetate is discussed. (CH)

10102 RENAL IMAGING IN PEDIATRICS. Freeman, L. M. (Johns Hopkins Hospital, Baltimore); Raynaud, C.; Koutulidis, C. pp 308-324 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

A variety of radionuclide imaging techniques are available for the study of renal disorders in children. Their ease of performance and safety have been well demonstrated in the last several years. The type of static or dynamic study applicable in a particular situation depends on the clinical problem being investigated. These are described in detail. It is hoped that the more widespread acceptance and performance of renal imaging studies, as well as future refinements in instrumentation and radiopharmaceuticals, will further establish their usefulness. The employment of radionuclides may also offer some additional insight into pathophysiologic mechanisms in pediatric renal disease. (auth)

10103 RENAL FUNCTION STUDIES IN PEDIATRICS. Blaufox, M. D. (Yeshiva Univ., Bronx, NY); Sikalns, G.; Jeck, D.; Spitzer, A.; Chervu, L. R.; Edelmann, C. M. Jr. pp 324-334 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Radionuclide procedures, when combined with the appropriate imaging techniques, provide an overall assessment of renal function with a relatively minimal radiation dose to the child and compete favorably with commonly used radiographic techniques. They are especially suitable for follow-up studies once the anatomy of the urinary tract has been clearly delineated by radiography. The radioisotopic procedures permit atraumatic and easily performed follow-up studies of the results of medical therapy and other forms of conservative management or of surgery. As with any other isotopic procedures in children, there should be clearcut indications for their performance and definite advantages to the patient over alternative nonradionuclide methods. (auth)

10104 BONE SCANNING IN PEDIATRICS. Bell, E. G.; Subramanian, G.; Blair, R. J.; McAfee, J. G. (State Univ. of New York, Syracuse). pp 335-354 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Bone scanning in the pediatric age group has not been widely employed in the past owing to lack of a completely satisfactory bone-seeking radiopharmaceutical. Since the use of ^{85}Sr was restricted to the study of patients with known malignant disease, the popular notion arose that bone scanning was useful only in the study of oncologic disease. However, the radiation dose to the skeleton from the newer short-lived bone seekers is not prohibitive, and therefore, imaging studies may be safely undertaken for the investigation of benign skeletal disease in children, such as the evaluation for extent of primary bone tumor; evaluation for possible bony metastatic disease; evaluation for early osteomyelitis not seen by x-ray film; evaluation for fractures not disclosed by x-ray films; evaluation for possible arthritides; and evaluation for possible avascular necrosis. The agents presently in use are not specific and localize in benign as well as malignant disease. There is nothing in the offing at present which allows adequate differentiation between these two classifications. The characteristics offered by ^{99m}Tc polyphosphate, diphosphonate, or pyrophosphate with respect to their ease of preparation, high level of bone localization, low cost, low radiation dose, and the excellent quality of images obtained on the scintillation camera or scanner suggest that they are the best agents available. (auth)

10105 HEMATOLOGIC STUDIES IN PEDIATRICS. Pearson, H. A.; Spencer, R. P. (Yale Univ., New Haven). pp 355-364 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Radioisotopic methods for diagnosis and delineation of hematologic diseases in pediatric patients are being used with increasing frequency. Although they do not replace more conventional hematologic methods, they can provide vital information which is not otherwise obtainable. A close and understanding liaison between clinical pediatricians and nuclear medicine physicians is essential. Among the key factors contributing to this is the recognition by the pediatric staff of the versatility and utility of these methods, and the realization by the nuclear medicine staff of the peculiar problems of small patients, including technical difficulties in administration of isotopes, small size of blood samples, difficulties in immobilization, and so on. If pediatricians can be certain that their patients will be expertly and expeditiously handled, then use of these procedures will doubtless increase markedly. A consequence of this collaboration will be better diagnosis and understanding of small patients and their problems. (auth)

10106 RETICULOENDOTHELIAL STUDIES IN PEDIATRICS. McIntyre, P. A. (Johns Hopkins Medical Institution, Baltimore); Judisch, J.; Dibos, P. E. pp 364-375 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

It was concluded that the use of agents such as ^{99m}Tc sulfur colloid to obtain a complete RES scan (liver, spleen, and functional RES marrow) is of help in the diagnosis and management of some pediatric patients. Further evaluation of this technique in this age group is desirable, particularly in assessing its value in detecting remission and in aiding the prognosis of children undergoing treatment for acute leukemia. (auth)

10107 DIAGNOSIS OF THYROID DISEASES IN PEDIATRICS. Rosenfield, R. L.; Refetoff, S.; Hoffer, P. B.; Gottschalk, A.; DeGroot, L. G. (Univ. of Chicago). pp 376-399 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Tests utilizing radioisotopes in vivo must be used conservatively in the pediatric patient, since unnecessary exposure to radiation should be avoided. It is concluded that the serum TT_4 and FTI radioimmunoassay determinations are currently the best initial tests for assessing thyroid function in children. Thyroid scanning should be reserved for those cases in which focal thyroid lesions are sus-

pected, for it is of little benefit in diffuse goiters. If scanning must be done, the use of ^{99m}Tc pertechnetate or fluorescent techniques (if they are available) are preferable. (auth)

10108 ADRENAL IMAGING IN CHILDREN. Moses, D. C.; Beierwaltes, W. H. (Univ. of Michigan, Ann Arbor). pp 399-409 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The use of ^{131}I-labeled cholesterol (RIC) offers a safe, nontraumatic means of imaging the adrenal glands. It is a useful screening procedure and may help to avoid adrenal venography and arteriography in some patients with suspected adrenal tumors and hyperplasia. Congenital virilizing hyperplasia is the most common adrenocortical abnormality in childhood. Although this disorder is usually distinguishable from a virilizing adrenal tumor by differential urinary steroid excretion studies and also by the failure of dexamethasone to suppress the 17-ketosteroid excretion in the case of tumor, identification of abnormal adrenal glands has not been possible except by contrast angiography. Imaging with radiolabeled cholesterol may prove useful in screening patients not only for these relatively rare tumors but in identifying an adrenal origin of virilization in children. (CH)

10109 NUCLEAR MEDICINE PROCEDURES IN THE MANAGEMENT OF PEDIATRIC MALIGNANT DISEASE. Colman, M. (Univ. of Chicago); Hazra, T. A.; Wagner, H. N. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The use of nuclear medicine procedures in the primary diagnosis of tumors of many organs is of confirmed value. It is concluded that greater use can be made of these techniques in planning radiation therapy, monitoring the effects of treatment on normal tissues and tumors, and caring on a long-term basis for children who have been treated for malignant tumors. (auth)

10110 GASTROINTESTINAL PROTEIN LOSS IN PEDIATRICS. Waldmann, T. A. (National Cancer Inst., Bethesda, MD). pp 442-449 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Protein-losing enteropathy is a common phenomenon associated with many diseases of the gastrointestinal tract. Such loss may be secondary to disorders of gastrointestinal lymphatic channels, to ulceration of the gastrointestinal mucosa, or to mechanisms as yet undefined. Excessive gastrointestinal protein loss may be diagnosed by determining the fecal excretion of label following the intravenous administration of radiolabeled macromolecules such as ^{51}Cr-labeled serum proteins, ^{131}I-polyvinylpyrrolidone, ^{95}Nb-albumin, ^{59}Fe-dextran, or ^{67}Cu-ceruloplasmin. A complete analysis of protein metabolism may be achieved through the simultaneous use of ^{51}Cr-labeled serum proteins to determine the gastrointestinal clearance of proteins and ^{125}I-labeled serum proteins to determine the protein pool sizes, rates of protein synthesis, and protein catabolism. Studies with such agents are of major value in localizing the disease to the intestinal tract, in determining the activity of the gastrointestinal disease, and in following the efficiency of therapy of intestinal disorders in children. Such studies have led to the discovery of new clinical syndromes involving the gastrointestinal tract. (auth)

10111 IN VITRO TESTS WITH RADIOACTIVE TRACERS IN PEDIATRICS. Murphy, B. E. P. (McGill Univ., Montreal). pp 425-435 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The scope of in vitro tests in nuclear medicine is very rapidly widening. Almost all (and all those described here) involve protein-binding reactions. Radioisotopes are used either competitively (competitive protein-binding assays) to measure minute quantities of various substances, or noncompetitively as tracers to provide information about numbers of binding sites, relative binding, or relative saturation of binding sites. Competitive protein-binding assays, including radioimmunoassays, are used for almost all hormones and for several vitamins since they are extremely sensitive and specific. Their very high sensitivity is particularly advantageous for pediatric samples. (CH)

10112 ANTENATAL DETECTION OF HUMAN GENETIC DISEASE. Koback, M. M. (Univ. of California, Los Angeles). pp 436-442 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The development of methods for obtaining cells of fetal origin during early intrauterine life, coupled with the application of highly specific and sensitive in vitro biochemical and radiochemical methods, provides the basis for early prenatal detection of many severe human genetic disorders. The ability to detect such conditions in utero is an absolute prerequisite if fetal therapy or even correction is ever to be considered. It is more appropriate at present, however, that the intrauterine diagnosis of such untreatable, often fatal, or severely disabling conditions can provide a positive alternative to couples who might otherwise not chance the high risk of having a child so affected. If the couple elects to terminate those pregnancies in which an affected fetus is discovered, they could have selectively as many children as they desire, none of whom would suffer the disease in question. (auth)

10113 AUTOMATED DETECTION OF BACTERIAL GROWTH. DeBlanc, H. J. Jr. (Univ. of Utah, Salt Lake City); Wagner, H. N. Jr. pp 450-458 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

An automatic radiometric method for the detection of bacterial growth is described which has considerable potential in the clinical microbiology laboratory. The technique should increase the rapidity by which bacterial growth is detected in normally sterile fluids, such as blood and cerebrospinal fluid. It can be extended to antibiotic sensitivity testing and has the potential of automatically providing quantitative antibiotic sensitivity data within 3 hours after the beginning of testing. Its potential use as a method in public health screening for significant bacteruria is also described. (auth)

10114 BODY COMPOSITION STUDIES IN PEDIATRICS. Reba, R. C. (George Washington Univ., Washington, DC); Cheek, D. B.; Mellits, E. D. pp 458-473 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Measurements of lean body mass, total body water, extracellular water, intracellular water, and fat using isotope dilution techniques and whole-body counting are described. Applications of data in the evaluation of growth, fat content, nutrition, senescence, and drug and electrolyte dosage in infants and children are discussed. (CH)

10115 COMPLEMENTARY ROLE OF NUCLEAR MEDICINE AND ULTRASOUND IN PEDIATRICS. Sanders, R. C. (Johns Hopkins Univ., Baltimore). Pieroni, D.; Bearman, S.; James, A. E. Jr. pp 476-498 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Ultrasound provides a complementary modality to radiographic and nuclear medicine studies in some clinical circumstances and offers significant advantages in others. Areas which cannot be examined by nuclear medicine techniques can sometimes be imaged quite well by ultrasonography. If the two modalities offer approximately the same likelihood of providing the data for an accurate diagnosis of pediatric patients, ultrasound is preferable because of the ease of performance and lack of technical hazard and radiation dose to the patient. (auth)

10116 ANGIOGRAPHY IN PEDIATRIC DIAGNOSIS: ITS RELATION TO NUCLEAR MEDICINE. Harrington, D. P.; James, A. E. Jr.; White, R. I. Jr. (Johns Hopkins Univ., Baltimore). pp 498-512 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

Angiographic examination in childhood is an invasive process associated with some risk. Indications for use included: sequestration of the lung; demonstration of portal vein patency in portal hypertension; evaluation of chronic unexplained GI bleeding; differential diagnosis of hypertension; trauma; arteriovenous malformations; preoperative evaluation of liver neoplasms; and anatomical localization of islet cell tumors and pheochromocytomas. Controversial areas of use include: soft tissue masses; neonatal masses; renal masses in infants and children; and renal parenchymal and inflammatory lesions. (CH)

10117 VALUE OF NUCLEAR MEDICINE IN PEDIATRICS. Cooke, R. E. (Univ. of Wisconsin, Madison). pp 513-517 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The role of pediatric nuclear medicine in both research and diagnosis; limitations and constraints (technical, physiological, behavioral, and ethical); and suggestions for future orientation of efforts of both pediatrics and pediatric nuclear medicine are discussed. It is concluded that nuclear medicine techniques in pediatrics have a clear theoretical superiority over most radiographic approaches from the standpoint of radiation dose reduction. (CH)

10118 FUTURE OF PEDIATRIC NUCLEAR MEDICINE. Wagner, H. N. Jr. (Johns Hopkins Univ., Baltimore). pp 517-519 of Pediatric Nuclear Medicine. James, A. E. Jr. (ed.). Philadelphia; W. B. Saunders Co. (1974).

The nuclear physician must convince the public that he is guided by the assumption that any exposure to radiation carries some risk for the development of somatic effects, including leukemia and other malignancies, and of hereditary effects. This assumption implies that there is no wholly safe dose of radiation. On the other hand, failure to apply a diagnostic study may deprive the patient of a beneficial, perhaps at times a lifesaving procedure. It behooves the nuclear physician to improve his efforts to quantify the benefits of diagnostic procedures, especially in pediatric patients. Only in this way will society be able to balance in a rational manner the radiation risk and the benefit of the proposed study. (CH)

10119 RADIOLOGIC SEMINAR CXXIX: BONE SCANNING WITH TECHNETIUM POLYPHOSPHATE. Flowers, W. M. Jr. J. Miss. State Med. Ass.; 14: 286-288(Jul 1973).

^{99m}Tc labeled polyphosphate is a promising new bone scanning agent, currently under extensive clinical investigation in many nuclear medicine facilities. This discussion is primarily concerned with the detection of tumor metastases in bone, but the principles of bone scanning are not specific for neoplasm. Normal bone is constantly being formed and resorbed. There is a balance between bone mineral deposition and dissolution. In conditions of bone growth or repair, both formation and resorption may be accelerated. The use of appropriate radioactive tracers allows us to produce images of bone, and areas of increased skeletal activity can be clearly demonstrated. Non-uniform tracer distribution occurs normally in both adults and children. An understanding of normal activity patterns is essential for proper scan interpretation. There is localized increased activity around the epiphyses, around the acetabula and sacroiliac joints, and at the ends of the long bones. Most lesions of the skeleton, regardless of etiology, and whether osteoblastic or osteolytic, usually result in focal or diffuse increased activity on bone scans. Occasional lesions show decreased activity. (auth)

10120 TUMOR BLOOD-FLOW STUDY TO MEASURE RESPONSE TO TREATMENT. Tashima, C. K.; Lee, W. Y.; Leong, A. (St. Francis Hospital, Honolulu, HI). J. Nucl. Med.; 15: No. 6, 463(Jun 1974).

The response to radiation therapy has been correlated with changes in apparent blood flow in a vascular tumor. Blood flow scintigraphic studies using ^{99m}Tc were used to study a vascular metastases from carcinoma of the prostate. (CH)

10121 LUNG UPTAKE OF ^{99m}Tc-SULFUR COLLOID DURING LIVER SCANNING. Turner, J. W.; Syed, I. B.; Hanc, R. P. (Wesson Memorial Hospital, Springfield, MA). J. Nucl. Med.; 15: No. 6, 460-462(Jun 1974).

Lung uptake of ^{99m}Tc-sulfur colloid was demonstrated in a patient with lymphosarcoma and hepatic cirrhosis as underlying diseases. (auth)

10122 TUMOR UPTAKE OF ^{99m}Tc-POLYPHOSPHATE: ITS SIMILARITY WITH ^{87m}Sr-CITRATE AND DISSIMILARITY WITH ^{67}Ga-CITRATE. Chaudhuri, T. K.; Chaudhuri, T. K.; Christie, J. H. (Univ. of Iowa, Iowa City). J. Nucl. Med.; 15: No. 6, 458-459(Jun 1974).

Some differences in the uptake of three radiopharmaceuticals by a metastatic lesion from primary adenocarcinoma of the rectum are presented. A large tumor on the abdominal wall metastasized from rectal cancer picked up ^{99m}Tc-polyphosphate and ^{87m}Sr-citrate but not ^{67}Ga-citrate. This tumor uptake of Tc-polyphosphate and strontium was not attributable to increased tumor vascularity as evidenced from negative ^{113m}In-transferrin scan. (auth)

10123 PULMONARY VENO-OCCLUSIVE DISEASE. Calderon, M.; Burdine, J. A. (Baylor Coll., Houston, TX). J. Nucl. Med.; 15: No. 6, 455-457(Jun 1974).

Pulmonary veno-occlusive disease may be a not uncommon cause of pulmonary perfusion defects. In the case described, the condition produced a unilateral absence of perfusion due to asymmetric involvement of the major pulmonary veins. The etiology of the disease is obscure although it has been associated with the nephrotic syndrome, viral infections, otitis media, thrombophlebitis, and toxoplasmosis. Since approximately one-third of the reported patients have been less than 16 years of age, the possibility of congenital malformation of the veins has also been considered although this circumstance is unlikely in view of the typical pathologic changes. The extensive, progressive nature of the venous obstruction usually leads to death within a few months or years. Evidence of bronchial obstruction occurs due to edema of bronchial mucosa and engorgement of the bronchial veins. No effective therapy is available. The clinician should be aware of this condition in the differential diagnosis of lung perfusion and ventilation abnormalities using ^{99m}Tc-human albumin microspheres for perfusion studies and ^{133}Xe for ventilation studies. (auth)

10124 ^{133}Xe TRANSMISSION SOURCE. Darter, E. L. (St. Francis Hospital, Wichita, KS). J. Nucl. Med.; 15: No. 6, 453-454(Jun 1974).

The gaseous element ^{133}Xe has been used in a container of appropriate design as an extended source for transmission imaging of bone tissues. (auth)

10125 QUALITY CONTROL OF ^{99m}Tc-DTPA BY DOUBLE-TRACER CLEARANCE TECHNIQUE. Hosain, F. (Johns Hopkins Medical Institutions, Baltimore). J. Nucl. Med.; 15: No. 6, 442-445(Jun 1974).

Sn-DTPA kits were evaluated by the biological behavior of ^{99m}Tc-DTPA preparations as an index of the quality of the radiopharmaceutical. Plasma clearance and urinary excretion were determined in dogs along with a second tracer such as ^{113m}In-DTPA. Glomerular filtration rates were compared for the two tracers. The results could be divided into two categories corresponding to good and deteriorated ^{99m}Tc-DTPA preparations. A good product behaved kinetically in a manner almost identical to that of the second tracer. Deteriorated products showed reduced urinary excretion, higher plasma activity after 2 hr, appearance of a third component in the plasma clearance curves, and decrease in the calculated values of glomerular filtration rate. (auth)

10126 TOMOGRAPHY USING AN UNMODIFIED ANGER CAMERA. Payne, J. T.; Reinke, D.; Loken, M. K. (Univ. of Minnesota Hospitals, Minneapolis). J. Nucl. Med.; 15: No. 6, 439-441(Jun 1974).

Tomography can be carried out by manual movement of a standard gamma camera head. (auth)

10127 CLINICAL EVALUATION OF RADIOLABELED BLEOMYCIN (BLEO) FOR TUMOR DETECTION. Grove, R. B.; Reba, R. C.; Eckelman, W. C.; Goodyear, M. (Washington Hospital Center, DC). J. Nucl. Med.; 15: No. 6, 386-390(Jun 1974).

Bleomycin (BLEO), a chemotherapeutic agent known to concentrate actively in certain types of neoplastic tissue, was labeled in an effort to obtain a radiopharmaceutical of greater specificity and diagnostic accuracy for tumor localization. Studies were completed on 15 patients using ^{57}Co- and 9 patients using ^{111}In-BLEO and data were compared in each patient with data from ^{67}Ga-citrate. Semiquantitative analysis of the clinical scans with respect to visualization of the neoplastic lesions show that the use of ^{57}Co-BLEO did result in slightly higher sensitivity in the detection of tumors. (auth)

10128 USE OF ^{99m}Tc-DTPA FOR MEASURING GASTRIC EMPTYING TIME. Chaudhuri, T. K. (Univ. of Iowa, Iowa City). J. Nucl. Med.; 15: No. 6, 391-395(Jun 1974).

A rapid and easy isotopic method for measuring gastric emptying time (GET) is described. It involves the use of ^{99m}Tc-diethylenetriaminepentaacetic acid (DTPA) and a gamma camera with a computer. Results of animal experiments and 24 studies in 8 normal volunteers are presented. The radiopharmaceutical is neither absorbed from nor adsorbed to the stomach in any significant amount. Experimental data show less than 1% absorption of the compound in 30 min. The mean gastric emptying $T_{\frac{1}{2}}$ for a liquid meal in normal subjects was found to be 12 ± 3 min. Since ^{99m}Tc-DTPA fulfills the criteria as an ideal agent for measuring GET and the technique is noninvasive with reproducible results, it may have a potential clinical use. (auth)

10129 PERIHEPATIC HALO IN LIVER SCINTIANGIOGRAPHIC PERFUSION STUDIES: A SIGN OF ASCITES. Alter, A. J.; Farrer, P. A. (McGill Univ., Montreal). J. Nucl. Med.; 15: No. 6, 396-398(Jun 1974).

Three cases of massive ascites are presented in which a halo was observed around the liver on hepatic perfusion studies with ^{99m}Tc-pertechnetate. The cause, significance, and value of this finding are briefly discussed. (auth)

10130 ^{67}Ga-CITRATE IMAGING IN UNTREATED HODGKIN'S DISEASE: PRELIMINARY REPORT OF COOPERATIVE GROUP. Johnston, G.; Benua, R. S.; Teates, C. D.; Edwards, C. L.; Kniseley, R. M. (NIH Clinical Center, Bethesda, MD). J. Nucl. Med.; 15: No. 6, 399-403(Jun 1974).

An interinstitutional cooperative study was undertaken to evaluate ^{67}Ga as a tumor localizing agent. A uniform protocol and computer handling of data have been used. In 151 untreated patients with Hodgkin's disease, approximately 90% had one or more positive sites demonstrated on scan. Of histologically proven or clinically evident sites of tumor known by means other than scanning, 73% were positive. A false-positive rate of less than 5% was discovered. Of 249 lesions proven histologically or obviously apparent by other means, 21% were first detected by ^{67}Ga, although the sequence of procedures in the patient's workup may have some influence on this number. The percentage of positive scans is highest in the neck and chest. Gallium-67 imaging appears to have a place in staging Hodgkin's disease, but a negative scan does not exclude the presence of disease. In comparison with lymphangiography it appears to be slightly more sensitive but each of these procedures found lesions missed by the other. (auth)

10131 ^{67}Ga-CITRATE IMAGING IN UNTREATED MALIGNANT LYMPHOMA: PRELIMINARY REPORT OF COOPERATIVE GROUP. Greenlaw, R. H.; Weinstein, M. B.; Brill, A. B.; McBain, J. K.; Murphy, L.; Kniseley, R. M. (Marshfield Clinic, WI). J. Nucl. Med.; 15: No. 6, 404-407(Jun 1974).

An interinstitutional cooperative study was undertaken to evaluate ^{67}Ga as a tumor localizing agent. A uniform protocol and computer handling of data have been used. In 167 cases of previously un-

treated lymphoma (other than Hodgkin's disease) scanned with ^{67}Ga, approximately 78% had one or more positive sites demonstrated on scan. Of histologically proven sites, 51% had a positive scan and with those sites apparent or suspected but not biopsied, 54% were positive. Thus a negative scan does not exclude the presence of disease. A low "false-positive" rate was encountered; if a lesion is demonstrated by scan, it is highly likely that disease is present. Disease, unsuspected or believed absent, was first known at the time of scan in 28 sites. An additional 42 positive scan sites as yet unconfirmed by other evidence may also represent lesions discovered de novo by ^{67}Ga. The percent of positive scans is highest in the thorax. Histiocytic types, including mixed cell types, of lymphoma have higher rates of positive scans than lymphocytic types. Overall, the rate of positive scans is lower in lymphoma than in Hodgkin's disease. (auth)

10132 ^{67}Ga-CITRATE IMAGING IN UNTREATED PRIMARY LUNG CANCER: PRELIMINARY REPORT OF COOPERATIVE GROUP. DeLand, F. H.; Sauerbrunn, J. L.; Boyd, C.; Wilkinson, R. H. Jr.; Friedman, B. I.; Moinuddin, M.; Preston, D. F.; Kniseley, R. M. (Univ. of Florida, Gainesville). J. Nucl. Med.; 15: No. 6, 408-411(Jun 1974).

An interinstitutional cooperative study was undertaken to evaluate ^{67}Ga as a tumor localizing agent. A uniform protocol and computer handling of data have been used. In 172 untreated patients with primary lung cancer, approximately 84% had one or more sites demonstrated on scanning with ^{67}Ga; 80% of individual lesions histologically verified had positive scans. It is occasionally possible to detect rather small lesions and, conversely, on occasion to miss some large lesions (5 cm or larger). Negative scans were obtained in 16% of lesions histologically proven. In the present analyses, rates of detection differ somewhat according to histologic type but not strikingly. With further developments in tumor-localizing agents and instruments, the agent may eventually be useful in the initial diagnostic workup of suspected lung carcinoma in certain clinical situations. As a single screening scan procedure, it should prove helpful in assessing the extent of disease before surgery or other type of therapy. (auth)

10133 RADIOTECHNETIUM POLYPHOSPHATE JOINT IMAGING. Desaulniers, M.; Fuks, A.; Hawkins, D.; Lacourciere, Y.; Rosenthall, L. (Montreal General Hospital). J. Nucl. Med.; 15: No. 6, 417-423(Jun 1974).

An assessment of the efficacy of ^{99m}Tc-polyphosphate (^{99m}TcPP) in the disclosure of synovitis in 27 patients is presented. A comparison was made between ^{99m}TcPP, clinical evaluation, $^{99m}TcO_4^-$, and radiography. In general ^{99m}TcPP was found to be more sensitive in the detection of inflammatory synovitis in peripheral joints than the other three methods, but it is also nonspecific as increased periarticular accretions were found in degenerative osteoarthritis, metabolic bone disease, and trauma. Although ^{99m}TcPP joint imaging qualifies as a screening procedure, regions of increased uptake should be radiographed to determine whether other causative factors exist. (auth)

10134 ^{67}Ga-CITRATE AND THE NONFUNCTIONING THYROID NODULE. Kaplan, W. D.; Holman, B. L.; Selenkow, H. A.; Davis, M. A.; Holmes, R. A.; Isitman, A. T.; Chandler, H. L. (Harvard Medical School, Boston). J. Nucl. Med.; 15: No. 6, 424-427(Jun 1974).

Nineteen patients identified by ^{125}I, ^{131}I, or ^{99m}Tc-pertechnetate imaging as harboring a solitary cold nodule of the thyroid gland were evaluated further by ^{67}Ga-citrate thyroid scans. Histologic examination of the thyroid tumors was performed in all cases. Of the seven thyroid tumors shown to be malignant, only three selectively concentrated ^{67}Ga-citrate. Two of these were anaplastic carcinoma; the third was a mixed papillary-follicular carcinoma containing multiple foci of poorly differentiated cells. None of the 12 benign nodules in this investigation concentrated ^{67}Ga-citrate. These included follicular adenomas and colloid nodules. No cases of subacute or chronic lymphocytic thyroiditis were encountered. Results indicate that although ^{67}Ga-citrate may be of value in identifying anaplastic thyroid tumors, it has limited application in the diagnosis of solitary cold nodules. (auth)

10135 FRACTION OF INTRAVENOUSLY INJECTED ^{99m}Tc-SULFUR COLLOID IN THE SPLEEN OF CHILDREN. Spencer, R. P.; McIntosh, S.; Pearson, H. A.; Touloukian, R. J. (Yale Univ., New Haven). J. Nucl. Med.; 15: No. 6, 446-447(Jun 1974).

In ten cases, spleens surgically removed from children were counted to determine the fraction of intravenously injected ^{99m}Tc-sulfur colloid that had accumulated. Values for the percent uptake and percent uptake per gram of splenic tissue were obtained. (auth)

10136 ABSOLUTE AND RELATIVE DEFICIT IN TOTAL-SKELETAL CALCIUM AND RADIAL BONE MINERAL IN OSTEOPOROSIS. Cohn, S. H.; Ellis, K. J.; Wallach, S.; Zanzi, I.; Atkins, H. L.; Aloia, J. F. (Brookhaven National Lab., Upton, NY). J. Nucl. Med.; 15: No. 6, 428-435(Jun 1974).

There was a marked deficit in the total calcium content of the skeleton in a group of 40 osteoporotic patients as measured by total-body neutron activation analysis (TBNAA). A highly significant correlation (0.826, $p < 0.001$) was found between the bone mineral content of the radius (measured by absorptiometric technique) and total-body calcium (measured by TBNAA). However, the correlation was not as high as in the group of normal subjects (0.973, $p < 0.001$). The large inherent variability in the bone mineral content measurement (of the radius) and the inability to normalize these data often make it unsatisfactory for evaluation of the extent of osteoporosis in an individual. The total-body calcium measurement normalized for sex, age, and skeletal size provides a more accurate technique for evaluating the loss of bone mass and hence is a more useful index for quantitating the degree of osteoporosis in an individual. (CH)

10137 EVALUATION OF CONVENTIONAL NEPHROGRAPHY CHARACTERISTICS BY MEANS OF COMPUTERS AS AN EXAMPLE FOR THE USE OF COMPUTERS IN FUNCTIONAL DIAGNOSTICS AS PART OF NUCLEAR MEDICINE. Isotopenpraxis; 10: No. 2, 66-69(Feb 1974). (In German).

The use of a computer for the evaluation of conventional nephrographic curves is described, and a typical evaluation is given. The relevant measurement values and the thesaurus introduced for nephrographic analysis are discussed. (JSR)

10138 PEDIATRIC NUCLEAR MEDICINE. James, A. E. Jr.; Wagner, H. N. Jr.; Cooke, R. E. (eds.). Philadelphia; W. B. Saunders Company (1974). 559p.

Separate abstracts were prepared for the 41 chapters included. (CH)

For abstracts of individual chapters see: 9802, 9803, and 10080-10118.

10139 EXPERIMENTAL STUDY ON THE INFLUENCE OF ^{197}Hg-CHLORMERODRIN ON THE RABBIT EEG. Goetze, W. (Freie Univ., Berlin); Glaubitt, D.; Bingas, B.; Stoelzel, R.; Goerke, W. Ger. Med.; 3: No. 1, 4-6(1973).

Brain scanning with ^{197}Hg-chlormerodrin exposes the patient to high radiation doses. This brings up the question of EEG changes in connection with brain scanning. Therefore, the EEG changes were studied in 11 rabbits after i.v. injection of 50 μCi of ^{197}Hg-chlormerodrin. An EEG was recorded before and for 4 to 5 d after the injection. On the 2nd and 4th d post-injection the EEG of five animals showed marked changes, in six other animals less marked ones. Especially an increase in 7 to 9/sec waves was found. As the EEG changes described here do raise a question on the diagnostic value of this test, it will have to be checked whether in man brain scanning with ^{197}Hg-chlormerodrin and ^{99m}Tc-pertechnetate produces similar changes. (GE)

10140 OBSTRUCTIVE UROPATHY. Jockes, A. M. (St. Peter's Hospital, London). Semin. Nucl. Med.; 4: No. 2, 187-196(Apr 1974).

In the initial assessment and diagnosis of a patient with an obstructive renal lesion, intravenous urography is the primary investigative method, but renography will give important additional evidence about the functional integrity of the obstructed kidney. Intravenous urography can give very misleading information as to function. Once the anatomical facts are established by urography, the degree of obstruction and the changes in function in the obstructed kidney can be followed more efficiently by renography with far less irradiation dosage and less inconvenience to the patient; renography is also less expensive and less time-consuming than intravenous urography. (auth)

10141 MEASUREMENT OF RENAL BLOOD FLOW WITH RADIOACTIVE MICROSPHERES. Arruda, J. A. L.; Boonjarern, S.; Westenfelder, C.; Kurtzman, N. A. (Univ. of Illinois, Chicago). Proc. Soc. Exp. Biol. Med.; 146: No. 1, 263-264(May 1974).

Total renal blood flow was obtained by determining the ratio of radioactivity in the kidney to that in arterial blood sampled immediately after the injection of radioactive microspheres. The technique is described and the results are compared to those obtained by paraamino-hippurate clearance. (ERB)

10142 CARBON-MERCURY BOND BREAKAGE IN MILK, CEREBRUM, LIVER, AND KIDNEY OF RATS FED METHYL MERCURIC CHLORIDE. Garcia, J. D.; Yang, M. G.; Belo, P. S.; Wang, J. H. C. (Michigan State Univ., East Lansing). Proc. Soc. Exp. Biol. Med.; 146: No. 1, 190-193(May 1974).

A double-label technique was used to determine the carbon-mercury bond breakages in milk and milk fractions, cerebrum, liver and kidneys of rats one day after force-feeding double-labeled methyl mercuric chloride. Breakages of the carbon-mercury bond occurred mainly in the fat and casein fractions and not in the whey of milk. In the cerebrum, liver and kidney, the breakages of the bond were respectively 6.2%, 6.2%, and

8.0%. The ^{14}C and ^{203}Hg concentrations (percent of dose/g) were high in fat and casein fractions and low in whey fraction of milk. The ^{14}C radioactivities in milk were distributed 46.2% in fat, 32.3% in casein and 21.5% in whey. For ^{203}Hg radioactivities in milk, distribution was 55.1% in whey, 41.0% in casein and 3.9% in fat. Of the three organs studied, the kidney contained the highest percent of dose/gram tissue whereas the cerebrum contained the lowest. (auth)

10143 ABSTRACTS OF PAPERS PRESENTED AT THE PROCEEDINGS OF 21ST ANNUAL MEETING OF THE SOCIETY OF NUCLEAR MEDICINE. J. Nucl. Med.; 15: No. 6, 474-547(Jun 1974).

Abstracts are included of 335 papers presented at this meeting. (CH)

10144 METHOD FOR DETERMINING INCORPORATION OF ACETATE INTO CITRATE. Dixit, P. K.; Stern, A. M. (Univ. of Minnesota, Minneapolis). Proc. Soc. Exp. Biol. Med.; 146: No. 1, 176-185(May 1974).

A simple radiometric method is described to determine the incorporation of acetate or pyruvate into citrate. Following in vitro incorporation of these substrates by the tissues, they are converted to 'active acetate' which then condenses with oxaloacetate to form citrate. When 1-^{14}C acetate or 2-^{14}C pyruvate were added as tracers, the citrate was labeled at 1-^{14}C carboxyl position, which on oxidation was released as $^{14}CO_2$. Labeled acetate in the medium did not interfere with the quantitative recovery of small quantities of citrate formed. When monofluoroacetate (MFA) instead of acetate was added with labeled acetate as the substrate, monofluorocitrate was formed which accumulated in the tissues, perhaps due to block in further oxidation. There was an eight-fold increase in the labeled CO_2 evolution by liver tissue when MFA was used as the substrate. Of the three temperatures at which the reaction was studied, the maximum amount of citrate was formed at 27°. The ability of the different tissues of rats to synthesize citrate was varied. Kidney, liver, and heart synthesized far more citrate than the skeletal muscle, pancreas, and lungs. In vivo incorporation of acetate into citrate was studied by injecting 1-^{14}C acetate into rats who were poisoned with MFA before hand, and then sacrificing the animals 30 and 60 min after the labeled injection. Spleen, kidney, and lungs contained much greater radioactivity than that present in the whole blood. Heart and liver also exhibited marked elevation when compared with corresponding tissues from saline-injected control rats treated similarly. (auth)

10145 NORMAL SHOULDER VARIATIONS IN THE TECHNETIUM-99m POLYPHOSPHATE BONE SCAN. Genoe, G. A.; Moeller, J. A. (University Hospital, Jacksonville, FL). S. Med. J.; 67: No. 6, 659-662(Jun 1974).

Technetium-99m polyphosphate bone scans were done on 60 patients with known primary carcinoma. Since technetium-99m polyphosphate shortens scanning time, more skeletal areas can be imaged. Many patients had increased activity in one or both shoulders but no other scan or x-ray film abnormalities. The activity in the shoulders, which takes a characteristic doughnut shape, should not be called abnormal. Increased activity in the shoulders does not necessarily indicate a metastatic lesion when other scans and x-ray films are normal. Wider application of technetium-99m polyphosphate is encouraged. (auth)

10146 EVALUATION OF USEFULNESS OF ISOTOPE RENOGRAPHY WITH ^{131}I-HIPPURATE. Baranowska, B. (Centrum Medyczne Kształcenia Podyplomowego, Warsaw). Pol. Tyg. Lek.; 27: 2020-2023(1972). (In Polish).

Isotope renography was done in 170 cases: in 76 cases of arterial hypertension of various etiology, in 70 cases of urinary tract occlusion, and in 24 other diseases. The findings are analyzed. It was concluded that isotope renography is a good screening test in arterial hypertension permitting a rapid detection of occlusion of the urinary tract, for determining the degree of occlusion, and the activity of kidneys. In renal failure it can show quickly whether it is due to disturbances in urine outflow. (auth)

10147 ^{51}Cr ERYTHROCYTE SURVIVAL TIME IN WILSON'S DISEASE. Członkowska, A.; Konopka, L. Pol. Tyg. Lek.; 27: 1638-1640(1972). (In Polish).

In 15 cases of Wilson's disease with a long duration the survival time of ^{51}Cr erythrocytes was investigated. Shortening of the survival time of erythrocytes labeled with ^{51}Cr was found in 9 cases and it was not associated with anemia or other overt signs of hemolysis. A comparison of the obtained results of survival time of ^{51}Cr-erythrocytes with determinations of coeruloplasmin in the plasma, serum copper level, and 24-hour urinary excretion of copper failed to show any correlation. In the pathogenesis of raised hemolysis of erythrocytes in Wilson's disease, cirrhosis of the liver seemed to play an essential role. (auth)

10148 CURRENT STATUS OF NUCLEAR MEDICINE. Torizuka, K. Izotoptechnika; 17: No. 3, 119-129(Mar 1974). (In Hungarian).

10149 GENERAL CRITERIA FOR RADIOASSAYS BY COLLOID SCINTILLATION COUNTING UNDER OPTIMAL CONDITIONS. Fox, B. W. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Int. J. Appl. Radiat. Isotop.; 25: No. 5, 209-215(May 1974).

The colloid system has been examined from the point of view of optimization of the necessary conditions for successful counting. The appearance, viscosity and physical stability of the colloid have been studied throughout all the possible combinations of its components using the triangular co-ordinate system. These parameters are shown to be independent of one another and play no significant role in deciding the best conditions to use. Furthermore, any phase structure designations based on a combination of these parameters is open to question. An instrument Merit Stability Quotient number is suggested that seeks to allow the assignation of a unique number to compare the quality of a suggested combination of detergent, primary solvents, and solutes with a particular aqueous solution, so that claims of improved efficiency of different combinations from various authors can be rationally compared independently of local instrument efficiency. The Triton X-100 : xylene : water system employing PPO and POPOP is used as an example. (auth)

10150 CURRENT STATUS OF RADIOISOTOPES IN THE DIAGNOSIS OF BONE CANCER. Charkes, N. D. (Temple Univ., Philadelphia). pp 915-919 of Proceedings of the Seventh National Cancer Conference. Philadelphia; J. B. Lippincott Co. (1973).

From 7th national cancer conference; Los Angeles, California, USA (27 Sep 1972). See CONF-720937-.

To the older established bone scanning agents (^{85}Sr, ^{87m}Sr, and ^{18}F) is now added ^{99m}Tc-polyphosphate. This new scanning agent is available to every nuclear medicine laboratory in every hospital in bit form for easy preparation. The radiation dose to the patient is less than with any other commonly used tracer. (ERB)

10151 ELECTROENCEPHALOGRAM AND SODIUM PERTECHNETATE ^{99m}Tc BRAIN SCAN. Krishnamurthy, G. T.; Katakia, M.; Tomiyasu, U.; Blahd, W. H. (Veterans Administration Wadsworth Hospital Center, Los Angeles). Arch. Intern. Med.; 133: 414-417(Mar 1974).

Both electroencephalography and brain scanning are very sensitive diagnostic procedures. The EEG has an overall higher rate of false-positivity (15%) and a lower rate of false-negativity (18%). In contrast, brain scanning has an overall lower incidence of false-positivity (<2%), but a higher incidence of false-negativity (33%). Combined electroencephalographic and scanning procedures increase overall diagnostic accuracy for detection of intracranial lesions (85%). Brain scanning is more specific than EEG: the cause of the lesion can be predicted correctly in 64% of abnormal scanning, but in only 27% of abnormal EEGs. A lesion not detected by either scan or EEG is most likely to be vascular, small, and deep-seated. Brain scanning and electroencephalography are recommended as screening procedures of choice in routine investigation of patients in whom an intracranial pathologic condition is suspected. (auth)

10152 TECHNETIUM BRAIN SCANNING IN THE DIAGNOSIS AND MANAGEMENT OF CEREBRAL ABSCESS. Crocker, E. F.; McLaughlin, A. F.; Morris, J. G.; Benn, R.; McLeod, J. G.; Allsop, J. L. (Royal Prince Alfred Hospital, Camperdown, Australia). Amer. J. Med.; 56: 192-201(Feb 1974).

Eighteen patients with intracranial abscess were investigated over a 3 year period. Each patient was subjected to cerebral scanning with technetium-99m pertechnetate within 10 days of admission to the hospital. The scan accurately localized each lesion present. Brain scanning was found to be the most sensitive and accurate investigation in the early diagnosis and localization of intracranial abscess. When scans were performed and interpreted in careful clinical context, their accuracy approached 100 per cent. Serial scanning with the low-energy, gamma-emitting radiopharmaceutical technetium-99m pertechnetate was a sensitive and convenient means of monitoring the patients' response to therapy. The brain scan abnormality in cerebral abscess is due to focal breaches in the blood brain barrier, which occur at the cellular level and which are therefore not dependant upon the presence of an accumulation of macroscopic pus of sufficient size to displace vessels or ventricles. A cerebral scan should be performed whenever cerebral abscess is suspected. In this context it should precede the diagnostically ineffective and potentially dangerous lumbar tap. With careful clinical correlation, the brain scan should reduce the present high mortality rate in patients with cerebral abscess. (auth)

10153 REPEATED ADMINISTRATION OF ^{35}S-METHIMAZOLE: PATTERN OF ACCUMULATION AND OXIDATION BY THE RAT

THYROID. Pharmakiotis, A. D.; Alexander, W. D. (Gardiner Inst., Glasgow). Endocrinology; 94: No. 6, 1508-1513(Jun 1974).

Repeated administration (every 8 hr) of ^{35}S-methimazole to rats resulted in gradual accumulation of ^{35}S-radioactivity by the thyroid gland until the 7th or 8th dose was given. Following this a plateau-level was attained. Chromatographic analysis showed that the metabolite sulphate accumulated in a pattern similar to the ^{35}S total activity, whereas intact methimazole increased until the 3rd dose was given and, subsequently a plateau level in the thyroid was achieved: the level of this plateau was found to be proportional to dose with the two dose levels used (50 μg and 100 μg). The ratio sulphate/unmetabolized methimazole varied throughout the experiment and seemed to be inversely proportional to dose. The plasma ^{35}S radioactivity reached a plateau level in the case of the 50 μg dose and continued to increase throughout the study in the case of the 100 μg dose. A single dose experiment showed that the uptake and intrathyroid metabolism of ^{35}S-methimazole is affected by iodine intake and route of administration of the drug. (auth)

10154 RADIOIMMUNOASSAY OF PLASMA PROGESTERONE DURING THE REPRODUCTIVE CYCLE OF MALE AND FEMALE RING DOVES (STREPTOPELIA RISORIA). Silver, R.; Reboulleau, C.; Lehrman, D. S.; Feder, H. H. (Rutgers – The State Univ., Newark, NJ). Endocrinology; 94: No. 6, 1547-1554(Jun 1974).

An increase in progesterone secretion has been claimed to play a significant role in mediating the transition from courtship to incubation behavior in male and female ring doves (Streptopelia risoria). To test this idea, peripheral plasma progesterone concentrations were measured by radioimmunoassay throughout the reproductive cycle in male and female doves. In male doves, progesterone values averaged 1.27 ± 0.08 ng/ml (X ± SEM) plasma during the cycle. There were no significant changes detected in progesterone concentration during the cycle in males. In contrast, progesterone concentrations increased significantly in female doves by the fifth day of courtship. Mean levels in incubating and brooding females averaged 1.13 ± 0.11 ng/ml, whereas on the fifth day of courtship progesterone levels rose to a mean of 3.01 ± 0.30 ng/ml. Further analysis showed that there was a significant positive correlation between progesterone concentration and follicular development and oviduct weight during courtship. No significant correlations between progesterone level and follicular state or oviduct weight were found in females at other stages of incubation or brooding. It was concluded that although both the male and the female ring dove undergo a behavioral transition from courtship to incubation, only in the female is there a readily detectable increase in progesterone secretion correlated with this transition. (auth)

10155 RADIOIMMUNOASSAY OF RABBIT GROWTH HORMONE. McIntyre, H. B.; Odell, W. D.; Reichert, L. E. (Univ. of California, Torrance). Endocrinology; 94: No. 6, 1568-1576 (Jun 1974).

Preparation of rabbit growth hormone which is suitable for trace labeling is described. The molecular weight of rabbit growth hormone as determined by polyacrylamide-gel electrophoresis is 18,000. The assay uses purified rabbit growth hormone labeled with radioiodine-125. An enzymatic procedure which utilizes 4 μg of lactoperoxidase and 0.88 mM hydrogen peroxide was adapted for the iodination. The antiserum was prepared in rhesus monkeys and used in the assay in a final dilution of 1:100,000. The reference standard had a potency of 0.60 IU/mg by the body weight gain bioassay. Separation of antibody-bound growth hormone from free growth hormone was achieved with goat anti-monkey gamma globulin. The affinity constant of the antigen-antibody reaction of the assay equaled 10^9 L/M and the average standard deviation of duplicate aliquots within a single assay over the range of 2 to 50 ng was 1.9 ng (4%). Interassay variability over the same range for unknowns measured in two different assays was 2.8 ng (6%). Pituitary growth hormone concentration in the rabbit was found to be 68 μg-equivalents of the reference preparation per mg pituitary. (auth)

10156 RADIOIMMUNOASSAY OF RAT PARATHYROID HORMONE IN SERUM AND TISSUE EXTRACTS. Hargis, G. K.; Bowser, E. N.; Henderson, W. J.; Williams, G. A. (VA West Side Hospital, Chicago). Endocrinology; 94: No. 6, 1644-1649 (Jun 1974).

A sensitive radioimmunoassay, which will detect as little as 0.5 pg of purified bovine parathyroid hormone (PTH), has been developed to assay PTH in rat serum and rat parathyroid gland (PTG) extracts. Highly purified bovine PTH was used as standard and tracer. The antiserum was developed against partially purified bovine PTH in a chicken. The bound to free ratio (B/F) curves for varying concentrations of rat serum and PTG extracts were superimposable on B/F curves of the standard highly purified bovine PTH, indicating indistinguishable immunologic identities of these hormones as detected by this antiserum. PTH was detectable in all normal intact rats, but in no parathyroidectomized rats. Rats maintained on a low calcium (Ca) diet had serum PTH concentrations more than 3-fold those of rats fed a normal Ca diet. Nephrectomized rats had serum PTH concentrations almost 4-fold that of control rats, and parathyroid tissue PTH concentrations greater than 4-fold that of control rats. After an im injection of EDTA into normal rats, the serum PTH concentration increased promptly as the serum Ca decreased. Both values then returned toward the baseline over the following 4 hr observation. Utilization of this radioimmunoassay for rat PTH allows the rat to be used in further studies of factors regulating PTH secretion and metabolism. (auth)

10157 INVESTIGATION OF METABOLISM OF ^{24}Na AND ^{42}K BY WHOLE BODY RADIOMETRY OF PATIENTS WITH CARDIAC FAILURES PRIOR TO AND AFTER SURGICAL INTERVENTION. Ryskulbekov, A. U. (Moscow Medical Inst.). Med. Radiol.; 19: No. 4, 74-76(Apr 1974). (In Russian).

Whole-body counting following the administration of ^{24}Na and ^{42}K made it possible to follow electrolyte metabolism in cardiac patients before and after surgical intervention. Surgical treatment of heart defects led to normalization of the ^{24}Na and ^{42}K metabolism, whereas the effect was extreme in patients with blood circulation compensated before the operation. In the presence of post-operative complications normalization of the electrolyte metabolism did not occur. (tr-auth)

10158 LUNG SCANNING 99m TECHNETIUM MACROAGGREGATE AND METHOD OF PREPARATION. Ficken, V. J.; Halpern, S. E.; Miller, L. R. (to Univ. of Oklahoma Foundation, Inc.). US Patent 3,810,976. 14 May 1974. Filed date 20 May 1970. 10p.

A lung scanning agent and method, the agent comprising a ^{99m}Tc-sulfur-colloid macroaggregate stabilized with a dialdehyde are described. More specifically, the composition comprises a $^{99m}TcO_4^-$ solution of the desired activity together with gelatin, an acid, and thiosulfates and perrhenates of the metals of Group IA of the Periodic Table of the Elements. The composition is heated to produce the desired macroaggregate particles and a dialdehyde such as glutaraldehyde is added to stabilize the particles. A high percentage of the particles produced upon injection are initially distributed throughout the lungs and upon clearance distribute themselves throughout the reticuloendothelial system. (Official Gazette)

10159 GUIDE TO BONE SCANNING. Blumhardt, R.; Nusynowitz, M. L. (Army Medical Center, El Paso, TX). Amer. Fam. Physician; 9: No. 1, 153-157(Jan 1974).

The bone scan is a simple and safe tool in the diagnosis of both benign and malignant osseous involvement. It is usually superior to conventional radiography in sensitivity. Thus, the two procedures are complementary. Bone scanning is useful for the evaluation of osseous involvement in patients with malignant disease, for establishing the location of bone involvement for specific diagnostic or therapeutic techniques, for the evaluation of fractures, and for determining the activity of bone lesions. (auth)

10160 UNUSUAL RADIOGRAPHICAL-BRAIN SCAN DISSOCIATION PATTERN WITH RETICULUM CELL SARCOMA (MICROGLIOMA) OF THE BRAIN. Wechsler, A. F.; Tomiyasu, U. (Veterans Administration Wadsworth Hospital Center, Los Angeles). Bull. Los Angeles Neurol. Soc.; 39: No. 1, 1-8(Jan 1974).

Two patients with primary brain tumors of the reticulum cell sarcoma-microglioma group are presented. A striking feature in each case was a strongly positive brain scan localization of the lesion in the presence of normal or equivocal angiographic and pneumoencephalographic studies. As many of these tumors are radiosensitive, recognition of this unusual radiographical-brain scan dissociation pattern may prove to be important in diagnosis and subsequent treatment of this group of tumors. (auth)

10161 NOVAL COMPOSITIONS FOR RADIOTRACER LOCALIZATION OF DEEP VEIN THROMBI. Dugan, M. A. (to Research Corp.). US Patent 3,812,245. 21 May 1974. Filed date 21 Aug 1972. 4p.

Radiolabeled enzymes, namely ^{99m}Tc-Streptokinase and Urokinase, which have thrombolytic activity are provided. In view of the propensity to accumulate at the location of the thrombi provides an efficient means of locating said thrombi. (Official Gazette)

10162 EFFECTS OF BETAMETHASONE ON ^{59}Fe INCORPORATION INTO HEMIC AND NONHEMIC FRACTIONS IN THE FEMUR AND SPLEEN OF MICE. Teruel, J. E.; Carrera, M. A.; Scaro, J. L. (National Univ., Tucuman, Argentina). Acta Physiol. Latinoamer.; 23: 305-309(Apr 1973).

Simultaneous administration of betamethasone (BM) and ^{59}Fe increases the 6 hours uptake of the tracer by the femur. An additional dose of BM given 24 hours before maintains the levels of ^{59}Fe in the femur above the normal values over the next 48 hours. These changes are paralleled by increased amounts of iron recovered in the hemic fraction of the marrow. Such a precocious

effect cannot be due to a genuine increase of erythropoiesis and appears more likely related to an accumulation of labeled erythroid cells. In the spleen a parallel decline of either total or hemic ^{59}Fe uptake was observed. This might reflect an accelerated emigration of erythroid cells from the spleen to the peripheral compartment. (auth)

10163 RAPID DIALYSIS CELL IN THE ZIRCONYL GEL ASSAY FOR CARCINOEMBRYONIC ANTIGEN IN HUMAN SERUM. Zupchik, H. Z.; Saravis, C. A.; Feil, M. C.; Zamcheck, N. (Boston City Hospital). J. Nat. Cancer Inst.; 52: No. 5, 1459-1462(May 1974).

Radioimmunoassays for carcinoembryonic antigen (CEA) utilizing perchloric acid (PCA) extraction of serum or plasma require more than 24 hours to perform because complete dialysis of the extracts is necessary. Thin layers (1 to 2 mm) of PCA extracts of serum (1-ml duplicates) were dialyzed through semipermeable membranes held on disposable plastic templates. The thin layer plus the large surface area permitted removal of low molecular weight materials and neutralization of the PCA within 1 hour if dialyzed first against water for 30 minutes and then against 0.01 M ammonium acetate buffer (pH 6.6) for 30 minutes. After these steps (extraction and dialysis), the zirconyl phosphate gel (Z-gel) radioimmunoassay could be completed in an additional 3 to 4 hours. The assay detected as little as 1.25 ng CEA/ml serum and was reproducible; test results correlated well with those obtained by the Farr and Z-gel CEA assays. This dialysis unit retained the PCA extraction step of the Z-gel assay but shortened the time required to analyze specimens. (auth)

10164 DETECTION OF IMMUNE COMPLEXES USING ^{125}I GOAT ANTI(HUMAN IgG) MONOVALENT (FAB) ANTIBODY FRAGMENTS. Ludwig, F. J.; Cusumanoo, C. L. (Univ. of Florida, Gainesville). J. Nat. Cancer Inst.; 52: No. 5, 1529-1536(May 1974).

Separation and identification of immune complexes in serum were based on sucrose gradient velocity sedimentation of samples labeled with radioactive monovalent antibody (Fab' fragments) to human immunoglobulin. In vitro complexes formed from tetanus toxoid and human antitoxoid (TATC) appeared in the gradient as a "radiopeak" sedimenting at 10S rather than the normal 7S position for human IgG (HulgG). These complexes were stable under the conditions of the gradient. They could be dissociated at low pH and separated by filtration into two fractions: one which sedimented at the 7S position of HulgG when centrifuged with ^{125}I Fab, and another which reformed TATC after incubation with fresh tetanus-immune globulin and centrifugation with ^{125}I Fab. As little as 13 μg IgG could be detected easily by this technique; complexed IgG was quantified on the assumption that its interaction with ^{125}I Fab was similar to that of free IgG. A similar 10-11S radiopeak appeared in samples of sera from 5 cancer patients and 1 patient with Weber-Christian disease. Similar peaks were not seen in samples of sera from 10 normal healthy controls. A study of serial serum samples from 1 cancer patient showed a 10-11S radiopeak in preoperation serum that was significantly reduced 1 week after removal of the tumor. In serum taken 1 month after surgery, a small peak reappeared; recurrent disease was found subsequently. This method may have potential for detecting and isolating tumor antigens and the corresponding antibody for diagnostic tests and basic immunologic studies. (auth)

10165 BONE SCINTISCANNING WITH ^{87m}Sr. With Special Reference to the Diagnosis for Metastatic Bone Tumor. Suzaki, K.; Sakurai, T.; Moriya, H.; Hareyama, M.; Suekuni, M. (National Hospital of Sapporo). Rinsho Hoshasen; 19: No. 1, 51-58 (Jan 1974). (In Japanese).

Bone scintiscanning with ^{87m}Sr was studied in 29 cases with metastatic bone tumor. Twenty nine cases contained eight cases with bone metastasis of breast cancer, five cases with bone metastasis of lung cancer, two cases with cancer of the upper jaw, two cases with bone metastasis of prostatic cancer, two cases of bone metastasis of cancer of the esophagus, four cases with osteosarcoma, and one case each with bone metastasis of uterine cancer, cancer of the urinary bladder, cancer of the parotid gland, unknown cause, reticulum cell sarcoma, and fibrosarcoma. Strontium bone scanning and roentgenogram in the detection of lesions were compared. In addition, superiority for the diagnosis was studied in both methods. The findings by scanning were superior for the diagnosis in all eight cases with bone metastasis of breast cancer, and almost the same in the cases with bone metastasis of lung cancer. Generally, the findings by scanning were superior in 44.8% to those by roentgenogram. In addition, both x-ray study and scanning has the same diagnostic availability in 37.9%. There were 17.3% (reticulum cell sarcoma etc.) in which x-ray findings were superior to scintigraphic findings. From these results, 82.7% showed the availability for the diagnosis of primary and metastatic bone tumors. Histologically, the scanning findings were superior for 83.3% with adenocarcinoma. The osteolytic changes were detected in 87.6% by bone scanning, but the scintigraphic findings were inferior to those from x-ray study in prostatic cancer. In the scanning before and after radiation therapy in the cases with metastasis to the pelvis, variation of uptake was not seen immediately after 500 rads of irradiation. In the findings by scanning after 3 months, the decrease of uptake was proved. Lastly, nine cases were stated. (JA)

10166 BASIC INVESTIGATION ON THE MEASUREMENT OF IgE IN THE BLOOD USING A SOLID-PHASE RADIOIMMUNOASSAY KIT (PHADEBAS IgE TEST). Miyamoto, T.; Obkawara, K. I.; Nishimura, H. (Shinonogi and Co. Ltd., Osaka). Kiso To Rinsho; 6: No. 12, 2587-2599(Dec 1972). (In Japanese).

The materials, method, reagents, and measuring process of this kit are described. The coefficient of variation was about less than 10% in the same sample measured using this kit more than twice by the same investigator. In measuring the concentration of IgE in the blood, it is desirable to measure the sample after diluting it tenfold or more in buffer solution. IgE values increased when the unknown sample was diluted less than tenfold. When the incubation time became longer, the standard curve became steep. When the incubation time continued for more than 17 hours, the uptake rate became less than 10%, and almost plateau value was obtained in the same serum. While the incubation time was 6 hours, the uptake rate was about 10%, and the stability of the standard curve was a little lower than that of the standard curve prepared by 17 hours incubation. The major cause of measurement errors in using this kit was due to pipetting and the washing procedure of the precipitates after incubation. This kit can be used for 3 months as long as keeping it at 2 to 8°C and IgE value in the range between 1 and 400 U/ml (10 to 4000 U/ml in the serum with tenfold dilution can be measured with this Kit. (JA)

10167 IMPROVED METHOD OR RADIOCHEMICAL ASSAY, DELTA-AMINOLEVULINATE SYNTHETASE AND ITS APPLICATION TO THE STUDY OF THE LEVEL OF HEPATIC DELTA-AMINOLEVULINATE SYNTHETASE IN NORMAL RAT. Ohashi, A.; Sato, S. (Tohoku Univ., Sendai). Tohoku J. Exp. Med.; 111: No. 3, 297-304(Nov 1973).

An improved method of radiochemical assay of δ-aminolevulinate (ALA) synthetase was described that enabled us to study the behavior of ALA synthetase in the liver cytosol of normal rat. When hemin was administered to the normal rat, the level of ALA synthetase in the liver mitochondria decreased markedly and the level in the liver cytosol also decreased slightly. Therefore the total activity of ALA synthetase in the liver of normal rat declined sharply after the hemin administration. Under the physiological conditions in the normal rat, the regulatory role of hemin in the control of porphyrin synthesis may be ascribed mainly to the inhibition of synthesis of ALA synthetase rather than the inhibition of transfer of ALA synthetase from the liver cytosol into mitochondria. (auth)

10168 INVESTIGATION OF KIDNEY SCINTIGRAPHY USING ^{197}Hg-CHLORMERODRIN. Toyoda, N.; Gotoh, K. (Tenri Hospital, Nara, Japan). Hinyokika Kiyo; 20: No. 1, 1-5(Jan 1973). (In Japanese).

The ^{203}Hg-labeled chlormerodrin has been mainly used for kidney scintigraphy. However, ^{197}Hg-labeled chlormerodrin has the possibilities of repeated examinations and application to pediatrics because ^{197}Hg has a shorter half-life and less radiation exposure to patients than ^{203}Hg. Here fundamental and clinical investigation on ^{197}Hg-chlormerodrin for kidney scanning agent was performed with an idea that this scanning agent will be widely used in place of ^{203}Hg-chlormerodrin in the near future. A total of 20 cases was examined using ^{197}Hg-chlormerodrin and these results were compared with those of ^{203}Hg-chlormerodrin. There were some differences in conditions of taking the scintigrams, but no differences on obtained scintigrams were recognized. The most suitable time period for taking the scintigrams with ^{197}Hg-chlormerodrin was 3 to 24 h after the intravenous administration. The remaining radioactivity of ^{197}Hg-chlormerodrin in kidney 10 days after the intravenous administration was not observed because of its short physical half-life of 2.7 days and excretion in urine. The radioactivities of ^{197}Hg-chlormerodrin in the urine decreased as 100:10:1 ≈ in the first 24 h: the second 24 h: the third 24 h. No radioactivity was recognized after the third day. (auth)

10169 RENAL SCAN IMAGES WITH ^{99m}Tc-TRAC AND ^{203}Hg-CHLORMERODRIN ACCORDING TO KIDNEY FUNCTION. Oshiumi, Y. (Hiroshima Red Cross Hospital); Hirata, H.; Nishitani, H.; Koga, I.; Nakayama, T. Nippon Igaku Hoshasen Gakkai Zasshi; 33: No. 11, 863-876(Sep 1973). (In Japanese).

In twenty-four cases with renal disorders the scan images of ^{99m}Tc-penicillamin acetazolamide complex (TPAC) and ^{203}Hg-chlormerodrin were compared according to renal function. Fifty-two percent of those with Grade I and seventy-five percent with Grade II dysfunction had superior renal images with ^{99m}Tc-TPAC

as compared to ^{203}Hg-chlormerodrin. This scanning was especially useful when other methods of examination failed to provide adequate information about the morphology of the kidneys during severe renal disorders. ^{203}Hg-chlormerodrin is widely used in renal scanning. Since it accumulates primarily in the kidneys and its extra-renal excretion is slow, it is regarded an outstanding scanning agent. However, with a rather high dose of 5 to 10 rad/150 μCi to the kidneys, it poses a problem from the standpoint of minimizing patients' exposure doses. Labeled compounds with short half-lives, such as ^{113m}In and ^{99m}Tc used in scanning other organs, incur very small doses. Agents, to be appropriate for renal scanning, must meet the following criteria: 1. Accumulation of the agent must be specific for and of large concentration in the kidneys. 2. Extra-renal excretion must be slow. 3. Dose must be small. In addition, they should produce high quality images of the kidneys, even during severe renal disorders. ^{99m}Tc-penicillamine acetazolamide complex (TPAC) reported in 1972 by Halpern et al. is a superior agent in fulfilling these requirements. Even during very severe renal disorders it reportedly produces outstanding scan images. In the present study, we compared scan images obtained using ^{99m}Tc-TPAC with those using ^{203}Hg-chlormerodrin in patients with renal disorders. ^{99m}Tc-TPAC is very stable. Of that administered intravenously, ninety-seven percent is bound to serum protein, particularly to its albumin fraction. No more than 4 to 8 percent is extracted on a single passage through the kidney, the extraction becoming less with increasing time. Preparation is simple, as shown in a table. If a millpore filter is unavailable, the supernatant fluid can be administered intravenously. No side effects are observed. Scanning is best seen 60 to 70 min after injection. (auth)

10170 ABSORPTION, DISTRIBUTION, AND EXCRETION OF 3-^{14}C-DOXAPRAM HYDROCHLORIDE IN RATS. Takeda, T. (Shinshu Univ., Nagano, Japan). Shinshu Igaku Zasshi; 21: No. 2, 227-237(Jun 1973). (In Japanese).

Absorption, distribution and excretion of 3-^{14}C-Doxapram Hydrochloride in rats were studied. 3-^{14}C-Doxapram Hydrochloride was administered into the duodenum, and the absorption of 3-^{14}C-Dop HCl in the intestinal canal was studied by measuring radioactivity in the blood of the portal veins. In order to know the reabsorption and excretion, 1.0 ml of 3-^{14}C-Dop HCl was administered into the veins of the thighs using bile duct cannulation in about 300 g of weighting rats. Then, bile juice was collected after 24 hours. 0.3 ml of this bile juice was administered into the opening of the bile duct in the duodenum with whole bile-duct cannulation in other rats. The bile juice was collected after 48 hours. The amount of the blood in the portal veins was increased, from 6 to 15 minutes, and was constant within a limit of 2 μg/ml until 20 to 120 minutes. Excretion of Dop HCl was administered into the bile duct, and radioactivity excreted in the bile juice reached more than 60% within 48 hours. Then, the disturbance in the body, the excretion of the intestinal canal, the absorption and the distribution in the brains were studied. 10 ml/kg of 3-^{14}C-Dop HCl was administered into the veins of the thighs and the distribution of it was measured 7 times for 15 minutes-24 hours. In the distribution of Dop HCl in rats, Dop HCl was comparatively high in the liver, the kidney, the lung, the spleen and the pancreas for 15 minutes-20 hours. In the distribution of Dop HCl in the digestive canal, Dop HCl showed highest value in the stomach, the duodenum and the small intestine administering Dop HCl. In the pregnant rats, the level of the lung in the fetus was almost the same as the pelvis and the urinary wall. The absorption of Dop HCl showed no barrier. Regardless of the parent body and fetus, 5 μg/g moisture weight was decreased in almost all the tissue after 24 hours of administration of Dop HCl. In the experiment of excretion, extracted radioactivity was identified as extraction rate. Extraction in the urine was 28% after 24 hours and 33% after 48 hours. Extraction in the stool reached to more than 60% after 72 hours. The blood concentration was decreased to 1/10 (15 seconds) after 3 minutes, and then after 16 hours almost disappeared. (JA)

10171 ROUTINE ULTRAMICRO-MEASUREMENT OF HUMAN GROWTH HORMONE IN PLASMA BY SOLID-PHASE RADIOIMMUNOASSAY. Ogawa, N. (Okayama Univ., Japan). Endocrinol. Jap.; 20: No. 6, 587-594(Dec 1973).

A method for the ultramicro-measurement of human growth hormone (HGH) in plasma based on the solid-phase radioimmunoassay (RIA) using antibody-coated disposable microtiter trays was described. This method is simple, rapid and inexpensive, and particularly useful for ultramicro-measurement of plasma HGH levels in large numbers of plasma samples. The lower limit of sensitivity for purified HGH was 25 pg/ml ($p < 0.05$). The precision of the measurement of HGH in plasma has been calculated, and the quantitative sensitivity of the method derived from the results given by its routine use was 56.8 pg/ml ($P < 0.05$). The HGH level of normal pooled plasma in 10 replicates was 1,515 pg/ml (±126; 1 SD), and the coefficient of variation was 8.3%. The mean basal plasma HGH level after an overnight fasting in 23 normal males was 2,100 pg/ml (±1,491; 1 SD) by this method and 2,036 pg/ml (1,643; 1 SD) by double-antibody RIA, and in 23 normal females, 2,589 pg/ml (±1,189; 1 SD) and 3,300 pg/ml (±1,690; 1 SD) respectively; there was no statistically significant difference between the basal HGH level obtained from this method and that from double-antibody RIA in normal subjects. On the other hand, the mean basal plasma HGH level after an overnight fasting in 21 hypopituitary patients was 484 pg/ml (±282; 1 SD) by this method, and this value was significantly lower ($P < 0.001$) than 1,376 pg/ml (±498; 1 SD) by double-antibody RIA. These data show that determination of basal plasma HGH levels by this method is of much value in the diagnosis of hypopituitarism. (auth)

10172 ISOTOPE METHOD OF THYROXINE DETERMINATION BASED ON THE BINDING PROPERTIES OF SERUM PROTEINS. Gembicka, D.; Gembicki, M. (Akademia Medyczna, Poznan, Poland). Pol. Arch. Med. Wewn.; 49: 215-222(1972). (In Polish).

A modification of the method of thyroxine determination on a Sephadex column is described. Thyroxine labeled with radioactive iodine ^{125}I was used. The laboratory procedures are reported in detail. On the basis of determinations in a control group and in patients with thyroid crises and hypothyroidism a good correlation was found between the obtained results and the clinical state of the examined subjects. The results of investigations carried out as yet substantiate the opinion that if the established parameters of time, temperature, and pH are observed the method gives reproducible results and is sufficiently sensitive for clinical purposes. (auth)

10173 RADIOISOTOPE AND POLYCARDIOGRAPHIC TECHNIQUES FOR EVALUATION OF HAEMODYNAMICS IN PATIENTS WITH AORTIC VALVE DISEASES. Pracka, H.; Krzeminska-Pakula, M.; Tracz, W.; Surma, M.; Kaluzna, J. (Academy of Medicine, Lodz, Poland). Pol. Tyg. Lek.; 27: 4-6(1972). (In Polish).

In 68 patients with aortic valve diseases the dynamics of left ventricular contraction were studied using the method of Blumberger. Moreover, in 21 patients radiocardiographic investigations were carried out. An attempt was made to assess what changes develop in the individual parameters of the polycardiogram and radiocardiogram depending on the haemodynamic effects of the disease and the efficiency of the circulatory system. It was found that one single determination of the dynamics of left ventricular contraction by the method of Blumberger is not sufficient to assess the efficiency of the circulatory system in these patients. On the other hand, the analysis of the time of half decay of radioactivity in the left heart was very useful for assessment of the efficiency of circulation. (auth)

10174 INFLUENCE OF THE OCCLUSION OF SPLENIC VESSELS ON BONE MARROW RADIOIRON UPTAKE IN THE MOUSE. Aggio, M. C.; Bruzzo, M. T.; Fernandez, L. M.; Montano, M. J. (Univ. Nacional del Sur, Bahia Blanco, Argentina). Acta Physiol. Latinoamer.; 23: 165-170(1973).

It has been observed that in the mouse the primary response to increased demands of red cell production is splenic rather than medullary. To determine the role of blood supply on this behavior, distribution of radioiron in both organs was studied under normal conditions and after erythropoietic stimulation. The anatomical configuration of the splenic vessels permits the design of an experimental model in which blood flow may be total or partially suppressed. In normal mice bone marrow uptake is almost unaltered by the suppression of splenic circulation. After an erythropoietic stimulus, an intense splenic activation takes place and concomitantly radioiron incorporated by bone marrow decreases. However, if splenic blood flow is reduced by occlusion of the vessels, bone marrow uptake increases significantly above normal values. These results suggest the possibility of a competition between the splenic and medullary erythropoietic compartments in regard to disposable circulating iron, resulting in an imbalance between cellular proliferation and iron supply to the marrow. Differences in cellular environment and the possible effect of erythropoietin on the microcirculation of hemopoietic organs may explain some of these findings. (auth)

10175 BRAIN SCINTIGRAPHY WITH ^{99m}Tc PERTECHNETATE, ^{99m}Tc POLYPHOSPHATE, AND ^{67}Ga CITRATE. Jones, A. E.; Frankel, R. S.; Di Chiro, G.; Johnston, G. S. (National Inst. of Health, Bethesda, MD). Radiology; 112: No. 1, 123-129 (Jul 1974).

Nineteen patients with known or suspected neoplasms of the skull and/or brain were studied with ^{99m}Tc pertechnetate, ^{99m}Tc polyphosphate, and ^{67}Ga citrate. Lesions of the calvaria were detected most accurately with ^{99m}Tc polyphosphate. In some cranial lesions, ^{67}Ga citrate localized within the core, ^{99m}Tc polyphosphate outlined the periphery, and ^{99m}Tc pertechnetate demonstrated the

entire affected area. In postcraniotomy patients, the combination of ^{67}Ga citrate and ^{99m}Tc polyphosphate provided a basis for distinguishing the surgical scar from a recurrent intracranial tumor. Purely intracerebral lesions were generally poorly localized with ^{99m}Tc polyphosphate. (auth)

10176 NEW APPROACH TO THE EVALUATION OF PERIPHERAL VASCULAR DISEASE USING THE GAMMA CAMERA. Gerritsen, H. A.; Kazem, I.; Hasman, A.; Kuypers, P. J. (Catholic Univ., Nijmegen, Netherlands). Radiology; 112: No. 1, 115-121 (Jul 1974).

A simple tracer technique for the evaluation of peripheral vascular disease is described, consisting of an intravenous bolus of 8 mCi of ^{99m}Tc pertechnetate. The arrival and distribution of activity in calf muscles of both legs during maximum reactive hyperemia are continuously recorded, and the typical pattern of the time–activity curve obtained in normal subjects is compared with that seen in occlusive disease. This technique is clinically useful as an atraumatic screening test prior to arteriography for the detection of impaired peripheral vascular circulation, for selection of patients suitable for vascular surgery, for postoperative evaluation of corrective surgery, and for follow-up of patients. (auth)

10177 TRANSMISSION SCANNING IN THE MEASUREMENT OF REGIONAL VENTILATION: A COMPARISON WITH XENON-133. Secker-Walker, R.; Alerson, P. O.; Hill, R. L.; Potchen, B. J. (Washington Univ., St. Louis). Radiology; 112: No. 1, 109-114(Jul 1974).

From 58th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (26 Nov 1972).

Regional changes in gamma transmission were measured in 23 subjects during natural and deep breathing using a disc source of technetium-99m and a gamma camera and spirometer interfaced to a small digital computer. Changes were measured as the logarithm of the difference in transmission between end-inspiration and end-expiration, and also as the rate of change of transmission during inspiration and expiration. Results were compared to figures for regional ventilation obtained from studies with xenon-133. Good correlation of this method and xenon-133 studies was found in normal subjects but in patients with delayed clearance of xenon-133, correlations were weaker and frequently not significant. This method is no substitute for xenon-133 studies in assessing patients with obstructive airways disease. (auth)

10178 MEASURING REGIONAL MYOCARDIAL BLOOD FLOW WITH ^{133}Xe AND THE ANGER CAMERA. Holman, B. L.; Adams, D. F.; Jewitt, D.; Eldh, P.; Idoine, J.; Cohn, P. F.; Gorlin, R.; Adelstein, S. J. (Harvard Medical School, Boston). Radiology; 112: No. 1, 99-107(Jul 1974).

From 58th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (26 Nov 1972).

Regional myocardial blood flow was measured using the inert gas washout technique and the Anger scintillation camera following injection of ^{133}Xe into the coronary artery. By applying compartmental analysis to 30-minute washout curves, three compartments were delineated, representing blood flow to fat and myocardium. Regional heterogeneity of flow was a highly sensitive index of coronary artery disease. Functional images delineated areas of altered perfusion better than quadrantic flow values. Gamma camera images of initial xenon distribution identified patients with severely altered flow. (auth)

10179 TUMOR DETECTION AND LOCALIZATION WITH ^{99m}Tc–TETRACYCLINE. Holman, B.; Kaplan, W. D.; Dewanjee, M. K.; Fiegel, C. P.; Davis, M. A.; Skarin, A. T.; Rosenthal, D. S.; Chaffey, J. (Harvard Medical School, Boston). Radiology; 112: No. 1, 147-153(Jul 1974).

The use of ^{99m}Tc-tetracycline as a tumor-localizing agent for external scanning was assessed in rats, mice, rabbits, and man. Tumors were successfully delineated in 14 of 18 patients studied. Chemotherapy and radiotherapy appeared to inhibit tumor uptake of ^{99m}Tc-tetracycline; background activity due to uptake by the gastrointestinal and urinary tracts diminished detection of tumors within the abdomen. Outside of the abdomen, patient scintiscans accurately demonstrated the number and extent of the lesions. (auth)

10180 APPLICATION OF ELECTROPHORESIS IN SOLUBLE POLYACRYLAMIDE GEL FOR DETERMINATION OF PROTEIN FRACTION SPECIFIC RADIOACTIVITY. Martinenko, F. P.; Rozhko, O. T.; Novikova, N. P. (Inst. of Endocrinology and Metabolism, Kiev). Ukr. Biokhim. Zh.; 46: No. 2, 252-254(1974). (In Ukrainian).

Separation of proteins labeled with radioisotopes by electrophoresis in soluble polyacrylamide gel makes it possible to determine quantitatively the content of individual proteins or protein fractions and their specific radioactivity. (auth)

10181 METHOD FOR THE DETERMINATION OF SPECIFIC RADIOACTIVITY OF PHOSPHATE IN ADENOSINE TRIPHOSPHATE AND ARGININE PHOSPHATE IN BIOLOGICAL MATERIAL. Strunecka, A.; Novakova, O.; Kubista, V. (Charles Univ., Prague). Physiol. Bohemoslov.; 23: No. 2, 107-111(Apr 1974).

A method for the determination of specific radioactivity of phosphates in adenosine triphosphate and arginine phosphate is described. The enzymatic method described previously (Bowen and Kervin 1965) was combined with high-voltage ionophoresis and the butanol-extraction method for determination of inorganic phosphate. The method is suitable for assaying samples comprising fractions of a gram and enables the determination of the specific activity of phosphate groups of ATP as well as for the specific activity of phosphagen. (auth)

10182 USE OF STABLE ISOTOPES IN GAS CHROMATOGRAPHY–MASS SPECTROMETRIC STUDIES OF DRUG METABOLISM. Horning, M. G.; Stillwell, W. G.; Nowlin, J.; Lertratanangkoon, K.; Carroll, D.; Dzidic, I.; Stillwell, R. N.; Horning, E. C.; Hill, R. M. (Baylor Coll, Houston, TX). J. Chromatogr.; 91: 413-423(24 Apr 1974).

Internal reference compounds labeled with stable isotopes have been used to quantify drugs and drug metabolites in urine, plasma and breast milk. [2,4,5-$^{13}C_3$]Diphenylhydantoin, [2,4,5-$^{13}C_3$] phenobarbital and [1-C^2H_3] valium have been used to quantify diphenylhydantoin, phenobarbital and valium, respectively; [2,4,5-$^{13}C_3$]pentobarbital has been used to quantify amobarbital, secobarbital, butabarbital and pentobarbital. Analyses have been carried out in the picogram to nanogram range by selective ion detection with two gas chromatograph-mass spectrometer-computer systems. Instrumental measurements with picogram samples have also been made using an atmospheric pressure ionization mass spectrometer. (auth)

10183 COMPARATIVE EVALUATION OF SCANNING AND RADIOLOGICAL METHODS IN THE STUDY OF RENAL DISEASES OF SURGICAL INTEREST. Contarano, G.; Bompiani, C.; Falcetti, E.; Micali, F. Nunt. Radiol.; 35: No. 9, 817-830(Sep 1969).

For a comparative evaluation, various radiological studies of the kidneys and renal scanning were examined. Among the various radiological methods, apart from the traditional ones such as urography and pielography, methods that supply more information on the conditions of the renal parenchyma such as drip infusion urography, nephrotomografy, selective artheriography, and aorthography were studied. Besides scanning, methods employing radioisotopes include the use of the scintillation camera, which has been employed in a smaller number of cases. A few kidney diseases of prevailing surgical interest are reported. In general, radiological examination and radioisotope scanning may be considered as complementary since they confirm or complete the information obtained by employing one or the other. Nevertheless, as regards the study of parenchyma, radioisotope scanning has the advantage of being quite easy to perform and of having no contraindications. Since radioisotope scanning gives a representation of the renal parenchyma, it proves particularly useful to the study of renal displasyas. In other cases, it gives indications of partial or total parenchymal alterations which cannot be obtained with the employment of urography or pielography. In many instances, radiological examinations that study renal vascularization provide more detailed information as they can show vascular alterations responsible for parenchymal impairments or caused by renal masses and the presence of pathological vessels in case of malignant tumors. The scintillation camera adds to the information obtainable with scanning since it may give successive representations of the cortex, the medulla and the renal cavities and, in some cases, with the employment of certain radiopharmaceuticals, it shows whether the renal mass is vascularized. (auth)

10184 IN VIVO LOCALIZATION OF RADIOLABELLED ANTIBODIES TO CARCINOEMBRYONIC ANTIGEN IN HUMAN COLON CARCINOMA GRAFTED INTO NUDE MICE. Mach, J. P.; Carrel, S.; Merenda, C.; Sordat, B.; Cerottini, J. C. (Univ., Lausanne, Switzerland). Nature (London); 248: No. 5450, 704-706(19 Apr 1974).

The specific localization of ^{131}I-labeled antibodies against carcinoembryonic antigen in heterografts of human colon carcinomas growing in nude mice is reported and it is shown that they can be detected by external scintillation scanning. This enables the ability of antibodies directed against a well-characterized human tumor-associated antigen to concentrate in human tumors to be tested without performing preliminary experiments in patients. (auth)

10185 RADIOIMMUNOASSAY OF PROTEOHORMONES. Sedlak, J.; Antonic, B. (Oddelenie Klinickej Biochemie ZUNC-VSZ, Kosice, Czech.). Prakt. Lek.; 53: No. 4, 557-559(Jul 1973). (In Slovak).

The procedure for determining the growth hormone is presented as the model for the radioimmunological determination of the proteohormone. A list is presented of complete sets for the determination of proteohormones as well as a list of apparatus

available in Czechoslovakia for measuring the radioactivity of labeled samples. (INIS)

10186 TUMOR DEPOSITION OF ^{111}In STUDIES IN THE RABBIT. Ito, Y.; Okuyama, S.; Miyagi, T.; Takahashi, K.; Awano, T.; Sato, T. (Tohoku Univ., Sendai). Sci. Rep. Res. Inst., Tohoku Univ., Ser. C; 19: No. 4, 146-153(1972).

One of the drawbacks of ^{67}Ga scanning in its daily clinical application is its rather great affinity to infective lesions beside tumors. Indium-111 was studied to see if it possesses any merits over Ga in this regard. Twenty-five rabbits with intramuscular VX-2 epidermoid carcinoma were exposed to 540 microcuries of $^{111}InCl_3$ intravenously. Radioassay studies revealed that the kidney, bone marrow, spleen, and liver deposited more of radioactivity than the tumor. Ratio of tumor concentration to that of blood rose significantly on day-3 and thereafter. Bacterial abscesses deposited ^{111}In, but much less than the tumor. Binding of the radioisotope to the beta-globulin components of serum was suspected on gel filtration and electrophoresis. The subcellular, soluble fraction of the tumor was seen to deposit more radioactivity than that of the liver. Indium-111 yields a rather high ratio of tumor to blood and to muscle, and was confirmed to be one of the best tumor-scanning agents available. Infective lesions deposit much less radioactivity than in the case of ^{67}Ga; however, further studies are needed before definitive conclusions are drawn. (auth)

10187 COMPARISON OF A BIOLOGICAL AND AN IMMUNOLOGICAL ASSAY FOR THE MEASUREMENT OF PLASMA RENIN ACTIVITY. Nara, Y. (Niigata Univ., Japan). Niigata Igakkai Zasshi; 87: No. 10, 485-492(Oct 1973). (In Japanese).

Measurement of the plasma renin activity (R activity) using rough extraction of renal renin in pigs was fundamentally studied by bioassay (BIA) by Boucher and angiotensin (ang.) radioimmunoassay (RIA) by Haber et al. In addition, both BIA and RIA methods were compared with each other. In measurement method of R activity by BIA method, a condition of incubation, the rate of collection and reappearance were studied. In addition, R activity was measured in seven healthy males and eight females as subjects in immobilization for 4 hours and in standing for 4 hours. In RIA method, angiotensin I radioimmunoassay kit developed by CEA (Commissariat a l'Energie Atomique) was used. R activity was measured in ten healthy males and six females as subjects in immobilization (for 4 hours) and in standing (for 2 hours). As a result, it was possible to clinically apply in both methods. Especially, BIA method had low sensitivity, compared with that in RIA method, but was superior for reappearance. There was a significant relationship between R activity by BIA and that by RIA. The values by BIA were 1.7 times higher than by RIA, in the difference of conditions of plasma incubation. Angiotensin extracted by BIA method was studied by RIA method. As a result, angiotensin consisted of ang. I and ang. II. It was proved that ang. I was highly present compared with ang. II. It was possible for RIA method to measure R activity by using small amount of blood. In addition, RIA method was superior for sensitivity and reappearance. Therefore, it was considered that it is available for the clinical application, instead of BIA method. (JA)

10188 CESIUM-129 MYOCARDIAL SCINTIGRAPHY TO DETECT MYOCARDIAL INFARCTION. Romhilt, D. W.; Adolph, R. J.; Sodd, V. J.; Levenson, N. I.; August, L. S.; Nishiyama, H.; Berke, R. A. (Univ. of Cincinnati). Circulation; 48: 1242-1251 (Dec 1973).

The development of good quality cesium-129 myocardial images and the application of this technique to the recognition of myocardial infarction (MI) in animals and patients are described. The good quality of the myocardial images obtained strongly suggests the potential usefulness of the technique in the quantification of acute MI. (IAA)

10189 INHIBITORY EFFECT OF A STREPTOCOCCAL PREPARATION (OK-432) ON NUCLEIC ACID SYNTHESIS IN TUMOR CELLS IN VITRO. Ono, T. (Japanese Foundation for Cancer Research, Tokyo); Kurata, S.; Wakabayashi, K.; Sugawara, Y.; Saito, M. Gann; 64: No. 1, 59-69(Feb 1973).

The in vitro effect of OK-432 (NSC-B116209), the lyophilized preparation of penicillin-treated cell suspension of a low virulent strain, Su, of Streptococcus haemolyticus, on the metabolism of rat Yoshida sarcoma, ascites hepatoma AH-130, and mouse Ehrlich carcinoma cells was investigated. It was confirmed that living cells of Su strain released RNA from the tumor cells by contact in vitro, but OK-432 did not exert such an action at all. However, OK-432 was found to inhibit RNA synthesis and also DNA synthesis to a lesser extent in tumor cells in vitro in proportion to the dose of OK-432 applied. The effect of OK-432 on the RNA synthesis was compared using human malignant cells, HeLa, and nasopharyngeal carcinoma (NPC-204) cells, and phytohemagglutinin-stimulated normal human lymphocytes in culture. Among them, nasopharyngeal carcinoma cells were the most susceptible to the inhibition by OK-432. Protein synthesis of the carcinoma cells was also found to be highly sensitive to OK-432. These data seem to indicate that the extent of inhibition of RNA synthesis by OK-432 varies according to the cells tested and is roughly correlated to the susceptibility of tumor cells in vivo. (auth)

10190 ABSORPTION OF ^{131}I-LABELLED OLEINIC ACID IN VIRUS HEPATITIS. Kuydowicz, J.; Surma, M. (Akademia Medyczna, Lodz, Poland). Pol. Tyg. Lek.; 27: 1926-1928(1972). (In Polish).

An analysis was made of intestinal absorption of ^{131}I-labeled oleinic acid in 17 men in early periods of virus hepatitis that was based on measurements of radioactivity in stools and urine for 3 days. The results were compared with those of an earlier study of intestinal absorption of ^{131}I-labeled trioleine. The arithmetical mean of stool measurements was 14.6%, in urine 46.7% of the administered dose. The greatest disturbances were observed in patients with severe virus hepatitis. As compared with ^{131}I-trioleine, the ^{131}I-oleinic acid was absorbed much better in patients with virus hepatitis. It is suggested that the amount of unsaturated fatty acids should be raised in the diet of patients with virus hepatitis while the proportion of less easily absorbable neutral fats should be reduced. (auth)

10191 STUDY ON PORTAL CIRCULATION BY SCINTIPHOTOSPLENOPORTOGRAPHY. I. Portal Venography by $^{99m}TcO_4^-$. Kashiwagi, T. (Kansai Rosai Hospital, Japan); Kishida, M.; Kamada, T.; Suematsu, T.; Fusamoto, H. Kanzo; 14: No. 10, 537-546(Oct 1973). (In Japanese).

A new method for the study of portal circulation, obtained by injecting $^{99m}TcO_4^-$ into the spleen parenterally, was named scintiphotosplenoportography. The subjects were 23 male and 8 female cases, 19 to 72 years of age, of which diagnosis had been already certified. The obtained RI images were classified into the following four groups according to the movements of portal circulation: I) RI image showing the movement of normal portal circulation, II) RI image showing winding and meandering of the splenic vein, III) RI image showing shunted blood flow tract and liver image, and IV) RI image showing only shunted blood flow tract. The representative scintiphotos of each group were illustrated in figures. The whole of hemolytic anemia, cholelithiasis, chronic cholangitis, acute hepatitis, and carcinoma of the gall bladder belonged to I) group. Six out of 10 liver cirrhosis cases belonged to III) and IV) groups and presence of extrahepatic shunted blood flow was recognized. Liver fibrosis belonged to III) and IV) groups and idiopathic portal hypertension belonged to II) and IV) groups. Primary hepatoma which showed tumor embolism in the portal vein belonged to III) group. One case of carcinoma of the pancreas which showed splenic vein stenosis belonged to II) group. Presence of extrahepatic shunted blood flow by scintiphotos and presence of varices by esophagus x-ray and esophageal fiberscope were compared. As a result, scintiphotos showed the highest detection rate of shunt. From the above mentioned results, scintiphoto was thought to be a new method which could be substituted for splenoportography when investigating the movement of portal circulation. It was also suggested that diagnosis of esophageal varices could advance by using scintiphoto together with esophageal fiberscope. (JA)

10192 OBSERVATION OF THE PERIPHERAL CIRCULATORY DYNAMICS BY MEANS OF RADIOACTIVE ISOTOPES. With Special Reference to Diabetic Patients. Inada, M. (Tenri Yorozu Sodanjo Hospital, Nara, Japan). Hifu; 15: No. 3, 217-226(Aug 1973). (In Japanese).

By measuring the blood flow in organs using ^{133}Xe and ^{131}I, the peripheral circulatory dynamics in diabetes mellitus, in particular, was examined. The cutaneous blood flow was measured by the regional clearance method by injecting ^{133}Xe intracutaneously. Since the blood flow of patients with scleroderma is decreased, the present method seems useful for observation of the therapeutic course. However, since ^{133}Xe must be accurately injected into the skin, its application to local skin diseases is not suitable. The muscular blood flow was obtained by injecting ^{131}I into the anterior tibial muscle and measuring the ^{131}I clearance on reactive congestion. In diabetic patients complicated by retinopathy, renal disturbances, or nervous disturbances, the blood flow was decreased and the capillary diffusion capacity (CDC) was elevated. This is thought to indicate increased permeability of the capillary wall for iron. The blood flow in the foot was measured in application of the measuring method for blood flow in each organ with ^{133}Xe. The physiological saline solution of ^{133}Xe was rapidly injected from the femoral artery to obtain the mean blood flow in the first dactyl (MBF). By the rapid intra-arterial injection of ^{99m}Tc-labeled albumin into the femur, the mean transit time (MTT) of the blood flow of the floor of the dactyl capillaries was obtained. MBF showed a significant reverse correlation with MTT, so that its appropriateness was confirmed. Diabetic patients showed a fall of MBF in the first

dactyl. MBF fell even in some of the patients with no clinically prominent complication, indicating the possibility that the present test could be of help in detecting vascular disturbances which could not be pointed out by the pre-existing clinical tests. (JA)

10193 MEASUREMENT OF THE LABILE IRON STORES WITH SINGH'S TECHNIQUE AND CHEMICAL DETERMINATION OF IRON CONTENTS IN ORGANS OF RATS. Bobeck-Rutsaert, M. M.; Wiltink, W. F.; op den Kelder, M.; van Eijk, H. G.; Leijnse, B. (Academie Hospital, Rotterdam, Netherlands). Folia Haematol. (Leipzig); 109: No. 1-2, 104-109(1973).

Theoretically the basis for the validity of the formula of SINGH for determining the labile iron pool is relatively small. This is clear from a comparison of the specific activity of DF(desferrioxamine)-induced urinary iron and iron in different organs of rats. Practically the method of SINGH is valuable since a positive significant correlation exists between the DF-induced urinary iron excretion and the iron in iron stores of rats. (auth)

10194 SIGNIFICANCE OF FUMIGANT RESIDUES IN ANIMAL FEED. Alumot, E.; Nachtomi, E.; Bielorai, R.; Harduf, Z. (Agriculture Research Organization, Bet Dagan, Israel). pp 3-10 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

The chronic effects of ethylene dibromide (EDB) on chicken and rats were investigated in order to find out to what extent biochemical reactions involved in chronic poisoning by that compound are analogous to those in acute poisoning. The mechanism of acute EDB poisoning was also compared with that of acute carbon tetrachloride (CTC) poisoning. The study concentrated on the following main processes: occurrence of fatty livers, lipid oxidation in microsomal membranes, and reactions with SH-groups. Also methods were developed for controlling fumigant losses from feed and for accurate intake estimates in long-term feeding trials. It was concluded that EDB and CTC have different modes of acute action on a given species; these findings were supported by chronic intake studies. The formation of fatty livers appeared to be the most important symptom both in chronic and acute CTC poisoning, whereas EDB and ethylene dichloride (EDC) did not affect liver fat. Also chronic EDB poisoning did not change the levels of liver SH-groups as is observed in acute poisoning. (auth)

10195 FATE OF DIAZINON APPLIED TO RICE PLANTS. Huque, H. (Agriculture Research Council, Karachi, Pakistan). pp 29-32 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Three-week-old rice seedlings grown under simulated field conditions were treated with ^{32}P-labelled 0.4% diazinon granules at the rate of 1.75 lb per acre active material. Residues were determined radiometrically as well as by gas-liquid chromatography. The uptake of diazinon started within 24 hours of application and reached the highest concentration of 5.9 ppM on the third day. By the end of the fourth week the residue level fell to 0.6 ppM. (auth)

10196 CYCLODIENE AND OTHER RESIDUES IN GROWING CROPS. Klein, W. (Gesellschaft fuer Strahlenforschung St. Augustin, Ger.). pp 33-46 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Experimental work is reviewed that was carried out at the institute between 1969 and 1972 on cyclodiene and other pesticide residues in crop plants and in soil. Data are given for soil and foliar application of aldrin, dieldrin, kelevan, isodrin, and chlordane. Special attention is given to hydrophilic conversion products. The quantitative distribution of residues in various parts of crop plants and different soil depths is tabulated. (auth)

10197 TERMINAL RESIDUES OF MALATHION ON TEA: PRELIMINARY STUDIES. Manchanda, A. H. (Tropical Products Inst., London). pp 47-50 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Preliminary results are presented on the fate of ^{14}C-malathion in the fermentation and firing of tea leaves. 67% of the applied activity could be recovered by a series of extractions with solvents of increasing polarity. Unchanged malathion was found in all extracts. Metabolites were also present, one of which, on the basis of its i.r. spectrum, appeared to be malathion diacid. (auth)

10198 INFLUENCE OF PROCESSING ON THE DDT CONTENT OF MEAT PRODUCTS. Mirna, A.; Cornetti, K. (Federal Inst. for Meat Research, Kulmbach, Ger.). pp 51-58 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

[^{14}C]DDT, which had been applied in vivo to rabbits, was determined together with its metabolites in meat processed in various ways and in dry sausage. In all preparations residues consisted mainly of unchanged DDT (60-94%). Metabolites detected were DDD (3-8%), DCB (1-3%), DDE (1-2%) and DDA (0-2%). Curing and processing to dry sausage reduced the DDT content by some 30%. A micrococcus strain from a commercial starter culture for meat fermentation degraded DDT mainly to DDD and to a lesser extent to DCB. Lactobacilli were not able to metabolize the insecticide. (auth)

10199 FATE AND SIGNIFICANCE OF LABELED INSECTICIDE RESIDUES IN RICE. Tomizawa, C.; Endo, T.; Naka, H. (National Inst. of Agriculture Sciences, Tokyo). pp 59-64 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

The behavior and metabolism of S,S'-(2-dimethylamino) trimethylene bis(thiocarbamate) hydrochloride (Padan®) and N'-(4-chloro-o-tolyl)-N-methyl-N-methylthiomethyl formamidine hydrochloride (Hokupanon®) in rice plants were examined by radio-tracer techniques. Chromatographic and spectral analyses were applied to identify metabolites of the two insecticides in the rice plant. After application to the rice plant, Padan-^{35}S was rapidly converted to N,N-dimethyl-1,2-dithiolane-4-amine (nereistoxin), and the ^{35}S atom was finally detected as sulphuric acid. Similarly, rapid conversion of Hokupanon-^{14}C, ^{35}S to N'-(4-chloro-o-tolyl)-N-methyl-N-methylsulphinylmethyl formamidine (Hokupanon sulphoxide) took place after application, but the degradation rate of Hokupanon sulphoxide was fairly slow in the rice plant. It seemed that N-formyl-4-chloro-o-toluidine and 4-chloro-o-toluidine were minor metabolites. (auth)

10200 RADIOTRACER-AIDED STUDIES ON THE COMPARATIVE METABOLISM OF DIELDRIN ANALOGUES BY VERTEBRATES. Walker, C. H.; El-Zorgani, G. A.; Kenny, J. (Univ. of Reading, United Kingdom). pp 65-66 of Isotope Tracer Studies of Chemical Residues in Food and the Agriculture Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Comparative metabolic studies were made with dieldrin analogues HCE and HEOM in vivo (quail, pigeon, rat, rabbit) and in vitro (rook, jackdaw, fulmar, domestic fowl). Studies with liver microsome preparations showed that two distinct mechanisms are involved in the initial degradation in these species: oxidation and hydration to trans-dihydrodiols. With liver homogenates oxidative breakdown of HEOM prevailed in the case of the pigeon and the quail, whereas hydration was the principal mechanism in the case of rabbit and rat. In vivo experiments produced information on the rates and pathways of metabolic excretion. Ready biodegradability was matched by rapid excretion of the main metabolites which had been found also in vitro. (auth)

10201 MICROPOLLUTANT INTERACTION WITH MICROBES. Kokke, R. (Univ. of Tech., Delft, Netherlands). pp 81-85 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Evidence suggests that the interaction of micropollutants with microbes should be studied with organisms being in a steady-state equilibrium with their environment. In such a system, starting with 1 ppM of the herbicides diquat and 2,4-D, only a few per cent are accumulated by the microbes. Mercuric chloride is almost quantitatively absorbed. DDT absorption parallels microbiological lipid accumulation. (auth)

10202 FATE OF PESTICIDE RESIDUES IN VITICULTURE. Kovacs, J.; Antoni, F.; Vincze, L; Altmann, H. (Inst. of Medical Chemistry, Budapest). pp 103-110 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

The uptake of ^{14}C-labelled 2,4,5-T and 2,4,5-trichlorophenoxyethanol (2,4,5-TE) by grape leaves, grapes, and algae and its physiological effects were studied. In leaves herbicide concentrations reached a maximum after 12 hours. Transport occurred mainly through the leaf veins. The photosynthesis was inhibited. Phosphate and valine uptake were significantly inhibited by 2,4,5-T. Fractionation of extracted herbicide residues in grape leaves and algae indicated the presence of metabolites. On the surface of sprayed grapes 50% of 2,4,5-T applied as spray persisted after 3 weeks. (auth)

10203 FATE AND SIGNIFICANCE OF TRIAZINE HERBICIDES IN PLANT SYSTEMS AS DETERMINED BY ISOTOPE TRACER-AIDED STUDIES. Ries, S. K.; Wert, V.; Pulver, E. L. (Michigan State Univ., East Lansing). pp 111-118 of Isotope Tracer Studies of Chemical Residues in Food and the Agriculture Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

The effects of low levels of the herbicide simazine on barley, rye, and oat seedlings were studied. Water and nitrate uptake of the plants were enhanced resulting in increased plant weight and protein content. The effect is temperature dependent and accompanied by a decrease of water-soluble carbohydrates. ^{14}C-leucine incorporation studies suggest that simazine may have a direct influence on protein synthesis. (auth)

10204 FATE OF TOXIC ELEMENTS IN AQUATIC SYSTEMS. Rissanen, K. (Univ. of Helsinki). pp 113-118 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Recent work is summarized on the methylation of mercury in bottom mud and soil, on the metabolism and toxicity to fish of mercury, cadmium, and copper and on the kinetics of cadmium elimination from the human body. The mercury methylation rate in mud increased with organic matter content and temperature. The biological half-life of methylmercury in fish was longer than that of ethyl- and propyl-mercury. It was subject to species differences and dependent on methylmercury concentration as well as on temperature. Cadmium elimination by man followed a bi-exponential type curve. The fast component, which accounted for more than 90% elimination of the ingested dose, showed a half-life of 2.5 d. (auth)

10205 NOTE ON TRACER-AIDED STUDIES OF THE MOVEMENT OF TOXIC ELEMENTS IN SOIL-PLANT-WATER SYSTEMS UNDER CONTROLLED CONDITIONS. Stewart, J. W. B.; Rennie, D. A.; Halstead, E. H.; Huang, P. M. (Univ. of Saskatchewan, Canada). pp 119-120 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Soil concentrations of mercury, lead, arsenic, and nickel were determined at 30 sampling sites on cultivated soils representing the major soil orders in Saskatoon. Attempts were made to relate existing soil levels to parent subsoil composition and to the effect of weathering. Mercury uptake by wheat, alfalfa and rape-seed on contaminated soils was studied. Similar experiments were initiated to study the uptake of lead in dependence of nitrogen and phosphorus absorption. (auth)

10206 UPTAKE OF ADSORBED MONOLINURON BY PLANTS. Suess, A.; Grampp, B.; Siegmund, H.; Eben, C. (Bavarian State Inst. for Soil and Plant Cultivation, Munich). pp 121-124 of Isotope Tracer Studies of Chemical Residues in Food and the Agricultural Environment. Vienna; International Atomic Energy Agency (1974).

From proceedings of research coordination; Ispra, Italy (30 Oct 1972). See STI/PUB-363; CONF-7210116-.

Experiments on the fate of ^{14}C-monolinuron in soil showed that degradation of this herbicide proceeds more rapidly when it is adsorbed onto soil than in free form. Metabolic break-down occurs through arylamidase from soil bacteria but also through hydroxylation. Mustard and oat plants were able to take up soil-adsorbed herbicide during the first growing season. In subsequent growing seasons the uptake was smaller. Desorption from humic acids occurred more readily than from clay. (auth)

10207 IN VIVO ^{131}I SPECTRA FOR THYROID SCANNING. Chow, C.; Dias Neto, A. L. (Univ., Sao Paulo, Brazil). pp 124-134 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

In vivo ^{131}I spectra from the thyroid of a set of different patients were obtained and compared with the spectra from a phantom. A new window for the single channel analyzer is recommended. (auth)

10208 UTILIZATION OF RADIOISOTOPES EMITTING LOW-ENERGY RADIATIONS IN THE VISUALIZATION OF INTERNAL ORGANS. Dias Neto, A. L. (Univ., Sao Paulo, Brazil). pp 135-136 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

By the use of the physical characteristics of a low-energy, short life radioisotope (^{99m}Tc), a special detector, with a small crystal diameter, was developed for a medical radioisotope scanner. Two collimators, one a fine focus, the other a coarse focus, were constructed with thin gold foils as shielding material. The fine focus collimator, with a FWHM of 0.3 cm was designed specifically for scanning small and superficial organs like the thyroid. The coarse collimator, with a FWHM of 0.9 cm was designed for scanning the majority of organs of the human body, including the big and deep seated ones. Evaluation of physical characteristics of both collimators, is shown in detail and some clinical applications presented. (auth)

10209 MAGNETIC SPECTROSCOPY AND MOLECULAR DISEASES. Bemski, G. (Instituto Venezolano de Investigaciones Cientificas, Caracas). pp 261-276 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

Techniques of magnetic spectroscopy: electron spin resonance (ESR) and proton magnetic resonance (PMR) were used in the past few years in connection with studies of some abnormal human hemoglobins. Evidence obtained by ESR indicates that all the hemoglobins M in which the substituted residues are located next to the heme have a lower crystal field symmetry at the iron site of the affected hemes as compared with normal hemoglobin (HbA). If this interpretation survives some of the criticism levelled against it, it may open a way for understanding of further details of the electronic structure of the heme, as well as for possible diagnostic uses. Application of PMR to the studies of hemoglobins is a very recent development. The protons studied so far are those of the hemes themselves, the experiments are designed to see the changes in their resonance behavior as a result of substitutions at more or less distant groups in the protein. There is evidence that residue substitutions at the $\alpha_1\beta_2$ contacts in some abnormal hemoglobins produce changes in the spin density at the hemes. It seems therefore that propagation of effects of changed residues at distances of many Angstroms is actually taking place. A link is thus being established between clinical, chemical, and physical activities and the resonance techniques may help to elucidate the electronic changes in the protein produced by mutations and responsible for the clinical symptoms. (auth)

10210 EVALUATION OF RADIOHEPATOGRAPHIC CURVES OBTAINED USING ROSE BENGAL LABELED WITH ^{125}I. Neumann, H.; Golba, S. Pol. Przegl. Radiol. Med. Nukl.; 38: No. 1, 85-92 (1974). (In Polish).

The possibility of evaluation of the liver functions by means of radioisotope hepatography with ^{125}I is discussed. It is suggested that the half-period of secretion, the half-period of clearance, and the percentage content of blood in the liver should be calculated with mathematical formulas instead of using the graphic interpretation by the method of Loewenstein, which is time-consuming. (auth)

10211 DYNAMIC RADIONUCLIDE STUDY USING SCINTILLATION CAMERA. Yamasaki, T. (Tokyo Women's Medical Coll.). Tokyo Joshi Ika Daigaku Zasshi; 44: No. 2, 176-182(Feb 1974). (In Japanese).

Quantitative radionuclide studies of regional organ function appear to hold great potential usefulness for diagnosis and management of a variety of disorders. Radionuclide angiography, fractional renography, and regional pulmonary function study are discussed mainly. Radionuclide angiocardiography is valuable as a screening procedure for the detection of heart diseases. In this procedure, a short-lived radiopharmaceutical, usually ^{99m}Tc-pertechnetate is injected rapidly into a peripheral vein. Serial images are taken using a scintillation camera with a video tape recorder. The procedure provides a safe, uncomplicated approach for evaluating quantitative analysis in each organ. However,

appropriate care should be paid to the fact that the electric dead-time is too long to obtain an adequate data processing, which constitutes the marked limitation of the scintillation camera for dynamic radionuclide study. (auth)

10212 FUNCTIONAL RENAL SCINTIGRAPHY WITH DIFFERENT TRACERS. Zita, G.; Uiberrak, H. Muenchen. Med. Wochenschr.; 115: No. 32-33, 1413-1416(Aug 1974). (In German).

In the search for new radiopharmaceuticals for better evaluation of the renal function, some new preparations were tested recently and compared with earlier ones. The mean standard values for four renal test substances—^{131}I-Hippuran, ^{99m}Tc-DTPA-Fe-complex, ^{169}Yb-EDTA(DTPA), and ^{153}Sm-DTPA—are given. The results obtained with these substances on patients of various diagnostic groups differed in tendency. Final statements and a simplified indication for nephrologists and urologists can only be given after further studies have been made and more experience has been gained. (GE)

10213 SIMPLE FREE FAT CELL BIOASSAY FOR INSULIN. Moody, A. J. (Novo Research Inst., Bagsvaerd, Denmark); Stan, M. A.; Stan, M.; Gliemann, J. Horm. Metab. Res.; 6: No. 1, 12-16(Jan 1974).

A simple bioassay is described for insulin-like activity (ILA) which is based on the incorporation of (^{3}H) glucose into the lipids of isolated rat fat cells. Total lipids were extracted by adding toluene-based scintillation fluid directly to the incubation flasks, and the radioactivity in the lipids measured by liquid scintillation counting. Insulin dose-response curves with (2-^{3}H), (3-^{3}H) and (6-^{3}H) glucose were compared and those obtained with (2-^{3}H) glucose and (3-^{3}H) glucose were found suitable for routine use. (auth)

MATERIALS

10214 (AECL-4751) CHEMISTRY AND MATERIALS DIVISION. Progress Report, October 1–December 31, 1973. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1974. 107p. (PR-CMa-27). Dep. NTIS (US Sales Only) $8.50. AECL $2.00.

Research and development results are presented on ion penetration in metals and semiconductors, electron microscopy, radiation damage in Nb, nuclear analytical methods, nuclear chemistry, general chemistry, physical chemistry, materials science, Pd spectrometry, creep in Zr crystals, H–D separation, properties of D, and positron annihilation. (JRD)

10215 (JPRS-61919) NEW MATERIALS IN ENGINEERING. Popov, I.; Sviridov, V. 6 May 1974. Translation of Novye Materialy v Tekhnike, Izdatel'stvo Znanie, Moscow, 1973. 50p. NTIS.

An analysis is presented of the state of the scientific base and the trend in the future developments of some of the traditional and certain new building materials. (auth)

10216 (JUL-1027-MA) STATIONARY SOLUTION OF THE DIFFUSION EQUATION WITH DRIFT-TERM. Profant, M.; Walther, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Angewandte Mathematik). Dec 1973. 28p. (In German). Dep. NTIS (US Sales Only) $4.50.

An elliptical differential equation is treated, which describes the drift of lattice defects in a radiation damaged material. The solution of the equation is not of primary interest, but rather the value of the flux integral which is determined as the minimum value of the functional of the corresponding variational problem solved by the Ritz method. (GE)

10217 POSSIBILITY OF ISOTOPE TRANSMUTATION ALLOYING. Petrovic, J. J.; Vasudevan, A. K. (Wright-Patterson AFB, Dayton, OH). Scr. Met.; 8: No. 6, 669-674(Jun 1974).

The theoretical feasibility is discussed of Isotope Transmutation Alloying, which is the addition of a radioisotope to a nonradioactive solvent material so that the solvent properties are improved as a result of the in situ transmutation with production of metastable thermodynamic states. Examples of its application to the improvement of electrical properties of semiconductors (^{71}Ge decays to ^{71}Ga in Ge solvent) and to the strengthening of metals (Ag isotope decays to Pd, thus strengthening Al solvent) are described. (DLC)

Ceramics and Cermets

Refer also to abstracts 9095, 9226, 10263, 10264, 10357, 10358, 10470, 11831–11833, 11841, 11873, 12019, and 12020.

10218 (CEA-CONF-2595) GROWTH OF EPITAXIAL SUBSTITUTED GARNET FILMS BY HYDROTHERMAL SYNTHESIS. Ferrand, B.; Geynet, J.; Challeton, D.; Daval, J.; Joubert, J. C. (CEA Centre d'Etudes Nucleaires de Grenoble, (France)). 2 Nov 1973. 25p. (CONF-730994-2). Dep. NTIS (US Sales Only) $4.25.

From conference on magnetic bubbles; London, England, UK (4 Sep 1973).

The growth of magnetic garnet films by hydrothermal synthesis is reviewed. A new hydrothermal technique is described, which is based on the fact that the garnet synthesis is performed directly in the autoclave in weak basic concentrations (NaOH or KOH) avoiding a strong attack of the substrate and assuming uniform-thickness composition films. The best experimental conditions are given for growth of Ga : YIG, Gd : Ga : YIG, Eu : Ga : YIG, Eu : Ga : ErIG and Gd : Ga : ErIG. Magnetic observations are presented and the properties of hydrothermal garnet films are discussed and compared with those of liquid phase epitaxy and chemical vapor deposition garnet films. (auth)

10219 (CEA-R-4573) THERMODYNAMIC STUDY OF PLUTONIUM CARBONITRIDES AT HIGH TEMPERATURES. de Franco, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Apr 1974. 120p. (In French). Dep. NTIS (US Sales Only) $9.00.

Thesis. Submitted to Paris Univ., Orsay (France).

High temperature Pu–C–N ternary diagram is investigated using nitrogen pressure measurements obtained by reduction of PuN by carbon. Free energy of formation of Pu_2C_3, PuN, and $PuC_{1.00}$ is derived from these experiments between 1600°K and 2000°K. The ideality of the PuC–PuN solid solution is demonstrated for a N/Pu ratio greater than 0.75. Equilibrium pressure measurements have displayed the solubility of PuN in PuC_2, which is confirmed by neutron diffraction study of $Ce(C_2,N)$. A statistical model based on the pairwise interaction energies is established for a fcc crystal structure to account for nitrogen equilibrium pressure above the $Pu(C,N)–Pu(C_2,N)–C$ system. The energetic parameters computed are qualitatively analyzed. (auth)

10220 (CONF-7209109-, pp 214) STRUCTURE-PROPERTY RELATIONSHIPS IN THERMO-MECHANICALLY TREATED Ni–BeO ALLOYS. Grant, N. J. (Massachusetts Inst. of Tech., Cambridge). 1972.

From Japan–U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

Results are presented to show that optimizing thermomechanical treatments of Ni base alloys containing 2 vol % BeO leads to excellent alloy stress rupture properties at 2000°F and equally excellent properties at 25°C. (JRD)

10221 (KFK-1775) MEASUREMENTS ON THE EFFECT OF GRAIN BOUNDARIES ON THE ELECTRICAL RESISTIVITY OF URANIUM DIOXIDE. Schikarski, W.; Ondracek, G. (Kernforschungszentrum Karlsruhe (F.R. Germany)). Nov 1972. 3p. INIS.

10222 (KFK-EXT-6-74-1) IRRADIATION BEHAVIOR OF URANIUM NITRIDE. Zimmermann, H.; Dienst, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Feb 1974. 34p. (In German). Dep. NTIS (US Sales Only) $4.75.

Three irradiation capsules with annular UN pellets of an initial density of 95% TD and a UO_2 content of 5 to 10 vol% were irradiated in the FR 2 reactor to 10, 20, and 30 MWd/kgU burnup at mean linear rod powers of about 900 W/cm. The capsules contained thermocouples in the fuel center and in the thick-walled molybdenum TZM cladding tube. The maximum fuel center temperature was 1800°C. The gap conductivity between UN and cladding was 0.5 W/cm²/°C at the beginning of the irradiation and later about 4 W/cm²/°C under high contact pressure. Radiation-induced sintering led to a fuel density of about 98% TD during the first 10 MWd/kgU burnup. In the burnup range of 20 to 30 MWd/kgU and at a mean fuel center temperature of 1250°C a swelling rate of about 5.5%/10 MWd/kgU and a breakaway fission gas release were found. (auth)

10223 (ORNL-TM-4524) FUELS AND MATERIALS DEVELOPMENT PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1973. Patriarca, P. (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W-7405-eng-26. 180p. AT.

Research progress is reported on properties of Eu_2O_3 absorber materials, steam generator and heat exchanger materials, properties of structural materials, and properties of weldments for LMFBR. (JRD)

10224 INVESTIGATION OF ABRASIVE PROPERTIES AND WEAR-RESISTANCE IN SOME CARBONITRIDES OF TRANSITION METALS. Adamovskii, A. A.; Bezykornov, A. I.; Bilyk, I. I. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 79-83(Apr 1974). (In Russian).

Abrasive properties of titanium, zirconium, vanadium, and niobium carbonitrides are investigated. It is shown that most carbonitrides exceed electrolytically produced white corundum in abrasive ability but not green silicon carbide. During titanium microcutting at 34.3 m/sec, wear resistance of the carbonitrides is higher than that of green silicon carbide, the main abrasive material for treating titanium and its alloys. Carbonitrides with a slight content of nitrogen possess a higher wear-resistance in titanium microcutting. (auth)

10225 REGULARITIES OF WC–Co HARD ALLOYS WEARING IN LIQUID NITROGEN MEDIUM. Shnyrev, P. D. Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 74-78(Apr 1974). (In Russian).

The effects of friction mode and loading were studied as applied to WC–Co alloys wearing during test in the liquid nitrogen medium. It was established experimentally on the alloys BKC, BK6M, and BK60M that the value of volumetric wearing under constant loading is proportional to the friction mode and with the constant friction mode it is proportional to the loading, that corresponds to the regularities of abrasive wearing. (auth)

10226 BEHAVIOR OF TITANIUM, ZIRCONIUM, AND VANADIUM NITRIDES IN THEIR COMPOSITIONS WITH NICKEL–MOLYBDENUM ALLOY. Bondar, V. T. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 68-73(Apr 1974). (In Russian).

The behaviour was studied under conditions of hot pressing

and pressing with subsequent sintering in the hydrogen medium. It was established that interaction of hot-pressed samples in the studied systems proceeds as formation of limited solid solutions and is accompanied by recrystallization of the corresponding nitrides through the melted Ni–Mo binder. In the case of sintering of the composition TiN–Ni–Mo in the hydrogen medium, recrystallization of TiN was not found. (auth)

10227 PHASE EQUILIBRIA IN THE TERNARY SYSTEMS FORMED BY MOLYBDENUM AND TUNGSTEN WITH TRANSITION METALS OF GROUPS IV AND V OF THE PERIODIC SYSTEM AND WITH CARBON. Velikanova, T. Ya.; Eremenko, V. N. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 46-52(Apr 1974). (In Russian).

Phase diagrams of ternary systems (Mo,W) (Me_{IV},Me_V)–C according to the type of the singular complex are divided into two groups depending on the thermodynamic stability of cubic carbides of metals from groups IV and V of the periodic system. In all the systems under study, unlimited mutual solubility of cubic carbides is observed. The solubility discontinuity in the series (Me_{IV},Me_V)$_2$C observed in some cases (the crystallochemical conditions of continuous mutual solubility being kept to) is explained by high thermodynamic stability Me_VC_{1-x}. The additives of $Me_{IV,V}$ stabilize high-temperature modifications of molybdenum and tungsten carbides. (5 fig, 40 references) (auth)

10228 INVESTIGATION OF CHANGE IN PROPERTIES OF HARD ALLOY WC–Co UNDER STRAIN AND RETURN OF THESE PROPERTIES AT ANNEALING. II. Ivensen, V. A.; Chistyakova, V. A.; Eiduk, O. N. (All-Union Scientific-Research and Design Inst. for Refractory Metals, Moscow). Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 28-35(Apr 1974). (In Russian).

A change in physical and mechanical properties of the strained alloys WC–Co was studied after annealing at different temperatures. The dependences of the changes in these properties on the alloy structure and composition are detected. Particular course of return is explained by very intensive development of the process of hardness weakening and by preserving the hardness-weakening defects after annealing which removes the strain hardening. Suppositions are advanced on possible mechanisms of scaling type defects formation in the process of hard alloy strain. (auth)

10229 PHASE DIAGRAMS OF TERNARY SYSTEMS CONTAINING RARE EARTH METALS AND BORON AND THE CRYSTAL STRUCTURE OF THE TERNARY BORIDES. Kuz'ma, Yu. B.; Bilonizhko, N. S.; Svarichevskaya, S. I. pp 146-147 of Redkozemel'nye metally splavy i soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The phase equilibrium diagrams of the ternary systems {Y, La, Ce}–{Cr, Mo, W, Re}–B (12 systems) and {Y, La, Ce}–{Fe, Co, Ni}–B (7 systems) were studied by x-ray structural and microstructural analyses. The crystalline structure of the ternary borides were determined. (tr-auth)

10230 STUDIES ON THE Y–O, Y–C AND Y–N PHASE SYSTEMS. Carlson, O. N.; Lichtenberg, R. R.; Warner, J. C. pp 150-158 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The systems were investigated using techniques such as thermal analysis, x-ray diffraction, microscopy, and conductivity measurements. Special emphasis was placed on the regions of solid solubility in Y for O, C, and N. Phase diagrams are included. (JRD)

10231 POLYMORPHISM IN THE OXIDE SYSTEMS Ln_2O_3–ZrO_2 AND Ln_2O_3–HfO_2. Glushkova, V. B. pp 216-217 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The conditions for the preparation of the low-temperature metastable cubic forms of the oxides in the Ln_2O_3–ZrO_2 and Ln_2O_3–HfO_2 systems, where Ln represents the rare earths, were investigated. The effect of small additions of other oxides on the mechanism and kinetics of the phase conversion was studied. (tr-auth)

10232 CATION STRUCTURAL CLEAVAGES OF REFRACTORY COMPOUNDS OF THE RARE EARTHS. Caro, P.; Schiffmacher, G. S. pp 218-226 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In French).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The results of a study of refractory compounds of the rare earths with different structural cleavage are presented. The structural cleavages $(LnO)_n^{n+}$ are characteristics of the structure of numerous refractory compounds of the rare earths. (tr-auth)

10233 NEW OXYGENATED PHASES HAVING Ln^{3+} IONS WITH A DERIVED PEROVSKITE STRUCTURE. Fava, J.; Daoudi, A.; Salmon, R.; Le Flem, H.; Hagenmuller, P. pp 227-228 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In French).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

New results from studies on perovskites containing lanthanide ions are reported. The multiple substitutions possible permit the physical properties to be modulated. The various types of interactions resulting are discussed on the basis of magnetic-electrical measurements. (tr-auth)

10234 COMPARATIVE STABILITY OF TETRABORIDES AND HEXABORIDES OF THE RARE EARTHS. Hagenmuller, P.; Etourneau, J.; Mercurio, J. P.; Nasian, R. pp 229-236 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In French).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The study of the thermal stability of the tetraborides of the rare earths, all of UB_4 type, shows that they are more stable when the saturating vapor pressure of the metal is weaker and when the B-B bonds are shorter. The volatility of the metal and the stability of the B-B bonds give an explanation of the evolution of the stability of the hexaborides of the rare earths of CaB_6 type. (tr-auth)

10235 PRODUCTION OF MONOCRYSTALS OF A SERIES OF OXIDE COMPOUNDS OF THE RARE EARTH METALS. Bondar, I. A. pp 237-241 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

Data on the preparation of monocrystals of a series of silicates, germanates, and niobates obtained by spontaneous crystallization from solutions in melting of low-melting compounds are reported. Micrographs of $Gd_2Ge_2O_7$ and surface contours of $YNbO_4$ and $EuNbO_4$ are shown. (tr-auth)

10236 PHASE DIAGRAM OF THE BINARY SYSTEM ThO_2–La_2O_3. Sibieude, F. pp 242-253 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In French).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The phase diagram of the binary system formed by the refractory oxides ThO_2 and La_2O_3 was studied. The liquidus curves were determined by thermal analysis. It has no maximum corresponding to the existence of a congruent fusion compound. The phases present in the solid consist of primary solid solutions with structure analogous to the base compounds La_2O_3 and ThO_2 and of a series of intermediary hexagonal or rhombohedral phases. (tr-auth)

10237 RARE EARTH-BASED SEMICONDUCTOR COMPOUNDS. Samsonov, G. V.; Nashibov, I. O.; Sultanov, G. I.; Murgusov, M. N.; Muradov, A. R. pp 261-265 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From seventh conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The Ln_2Se_3–$SnSe_2$ cross section of the Ln–Se–Sn system, where Ln is La, Ce, Pr, Nd, and Sm, was studied. Ternary compounds with the structural formulas Ln_2SnSe_5 and $Ln_2Sn_3Se_8$ were found. (tr-auth)

10238 ELECTRON STRUCTURE OF SAMARIUM HEXABORIDES. Samsonov, G. V.; Paderno, Yu. B.; Lavandovskii, V. D.; Konovalova, E. S. pp 269-272 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The electrical resistance and thermo emf of SmB_6 was studied in the temperature range from 1.3 to 1100°K, the Hall effect at 4.2, 11.4, 70, and 293°K, and the thermal conductivity and magnetic susceptibility at 4.2 to 293°K. A model is proposed for the electron structure of SmB_6. (tr-auth)

10239 PREPARATION AND PROPERTIES OF MATERIALS FROM FUSED YTTRIUM OXIDES. Mogilenskii, V. I.; Polonskii, Yu. A.; Rudenko, L. F.; Skue, E. R. pp 273-274 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

Refractory materials based on fused Y_2O_3 were prepared. Their powder metallurgical properties were studied. (tr-auth)

10240 NATURE OF THE CHEMICAL BONDS OF RARE EARTH TELLURIDES BY MEANS OF THE MOESSBAUER EFFECT. Gorbachev, V. V.; Aleksandrov, A. Yu.; Linskii, V. A.; Sadovskaya, O. A. pp 306-307 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

The Moessbauer effect was studied in the tellurides of Pr and Nd with the purpose of obtaining data on the mechanism of formation of chemical bonds between the atoms of the magnetic (Pr and Nd) and nonmagnetic (Te) sublattices. (tr-auth)

10241 PRODUCTION OF HYDRIDS OF THE RARE EARTH METALS IN A CONTINUOUS PROCESS AT ATMOSPHERIC PRESSURE. Gaifutdinova, R. K.; Koneko, I. R.; Tolstopyatova, A. A.; Moreva, N. I. pp 321-322 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

A method was developed for the preparation of rare earth hydrides in which doubly sublimed metals and thoroughly purified hydrogen at atmospheric pressure were interacted with each other at temperatures from 200 to 400°C. Hydrides of La, Nd, Sm, Gd, Dy, Er, and Lu were prepared. The method used made it possible to analyze all processes of the interaction of rare earths with hydrogen. (JSR)

10242 MAGNETIC SUSCEPTIBILITY OF $V_2O_3-Al_2O_3$ SOLID SOLUTIONS. Bobrysheva, N. P.; Branch, B. Ya.; Dzagashtokova, M. M. Vestn. Leningrad. Univ., Fiz., Khim.; No. 22, 160-162(1973). (In Russian).

On the basis of the magnetic susceptibility dependence on the composition and temperature for $V_2O_3-Al_2O_3$, solid solutions the type of vanadium atoms arrangement in these solid solutions lattice is discussed. (auth)

10243 THERMODYNAMIC PROPERTIES OF URANIUM OXIDES AND NONSTOICHIOMETRY IN UO_{2+x}. Saito, Y. (Akita Univ., Japan); Iwano, Y. J. Jap. Inst. Metals; 38: No. 1, 78-86(Jan 1974). (In Japanese).

Thermodynamic properties of uranium oxides with O/U atomic ratios between 2.04 and 2.34, principally in the nonstoichiometric UO_{2+x} range, were obtained by the electromotive force measurement of solid state galvanic cells of the type: Ni-NiO|(0.85 ZrO_2 + 0.15 CaO)|uranium oxide, at temperatures from 500 to 1100°C. The relative partial molar free energies and equilibrium pressures of oxygen for the single-phase region UO_{2+x} and the two-phase coexisting regions UO_{2+x} - U_4O_{9-y} and U_4O_9-U_3O_{8-z} were determined from the electromotive force values with sufficient precision. The variation of the relative partial molar entropy of oxygen with the composition in the non-stoichiometric UO_{2+x} phase was derived on the basis of the 2:2:2 defect complex model proposed from the neutron diffraction study by Willis. The entropies were computed to fit the experimental data on the assumption that the excess oxygen ions entered in pairs into the fluorite structure, and that available sites for such oxygen pairs and U^{5+} ions were partially restricted. (JA)

10244 COMPOSITE NITRIDED MATERIALS. Rausch, J. J.; Van Thyne, R. J. (to Surface Technology Corp.). US Patent 3,802,933. 9 Apr 1974. Filed date 20 Mar 1972. 12p.

Graded nitrided articles are described that are surface modified in alloy composition so that the surface zone consists of nitrided alloys consisting essentially of (A) one or more metals of the group niobium, tantalum, and vanadium; (B) titanium; and (C) one or both metals of the group molybdenum and tungsten. A minor portion of the nitrogen may be replaced by oxygen or boron. Nitrided materials prepared from homogeneous alloys are also included. The materials are characterized by excellent wear and abrasion resistance. (Official Gazette)

10245 LATTICE ENERGIES OF Ti_nO_{2n-1} PHASES AND THE RELATED HOMOLOGS V_nO_{2n-1} AND $Ti_{n-2}Cr_2O_{2n-1}$ CALCULATED FROM CRYSTAL-CHEMICAL PARAMETERS. Houlihan, J. F.; Roy, R. (Pennsylvania State Univ., University Park). J. Amer. Ceram. Soc.; 57: No. 5, 234-235(May 1974).

An alternative method for calculating lattice energies is that of Kapustinskii (Quart. Rev., Chem. Soc.; 10: 283-294(1956)), which uses only ionic radii. Calculations by this method for the random-vacancy model and the idealized ordered-vacancy model were made for the Ti_nO_{2n-1} (n = 4 to 10) series. Similar calculations were also made for V_nO_{2n-1} (n = 4 to 8) and $Ti_{n-2}Cr_2O_{2n-1}$ (n = 6 to 9). (DLC)

10246 UNIDIRECTIONAL SOLIDIFICATION OF THE UO_2-Mo, UO_2-Nb, AND UO_2-Ta SYSTEMS. Jen, C. C.; Benzel, J. F. (Georgia Inst. of Tech., Atlanta). J. Amer. Ceram. Soc.; 57: No. 5, 232-233(May 1974).

Unidirectional solidification was accomplished by moving the molten zone in a rf field. $UO_{2.14}$ rods containing Ta cracked and swelled, while $UO_{2.03}-Ta$ produced well-ordered eutectic structures. The fiber areas of $UO_{2.03}-Ta$ samples solidified in N_2 or H_2 contained microcracks, but those solidified in CO or H_2 saturated with H_2O vapor did not have microcracks. UO_2-Mo produced only Mo spheres ($UO_{2.14}$-5% Mo) and aligned strings of Mo beads ($UO_{2.03}$-7% Mo) when solidified in N_2, indicating limited Mo solubility. Both $UO_{2.14}-Nb$ and $UO_{2.03}-Nb$, melted and solidified, had metallic coatings on their exterior surfaces and no metal in the interior. (DLC)

10247 EFFECT OF PRESSURE ON FORMATION OF $CaZrO_3$ BY SOLID-STATE REACTION BETWEEN CaO AND ZrO_2. Angers, R. (Univ. Laval, Quebec); Tremblay, R.; Chaklader, A. C. D. J. Amer. Ceram. Soc.; 57: No. 5, 231-232(May 1974).

Higher pressures (300, 2000, and 7500 psi) were applied to diffusion couples of ZrO_2/CaO at 1100 to 1500°C. Rate constants for the formation of $CaZrO_3$ were determined; their Arrhenius plots gave activation energies of 114 ± 8, 109 ± 16, and 42 ± 1 kcal/mole at 300, 2000, and 7500 psi, respectively. W markers indicate that Ca, not Zr, diffused through the $CaZrO_3$. The Arrhenius plot curves intersect at 1330°C. (DLC)

10248 EFFECT OF GRAIN SIZE ON CRACK PROPAGATION IN THERMALLY SHOCKED B_4C. Seaton, C. C.; Dutta, S. K. (Army Materials and Mechanics Research Center, Watertown, MA). J. Amer. Ceram. Soc.; 57: No. 5, 228-229(May 1974).

Hot-pressed dense B_4C prisms of 2 and 16 μm average grain size were thermally shocked and the bend strength measured. For the 16-μm B_4C, quasi-static behavior developed after thermal fracture initiation, suggesting that increasing the grain size increases the resistance to kinetic propagation of thermally induced cracks. But the increased grain size also resulted in a smaller furnace temperature at which the strength dropped. (DLC)

10249 MOESSBAUER STUDY OF $TbFe_{1-x}Cr_xO_3$. Nishihara, Y.; Nakamura, A. (Electrotechnical Lab., Tokyo). Denshi Gijutsu Sogo Kenkyusho Iho; 37: No. 5, 502-513(May 1973). (In Japanese).

Moessbauer study was performed to investigate into the effect of chromium ions on iron in the mixed crystals of ortho ferrite chromite. The radioactive source used for the experiment was ^{57}Co diffused into a Cu foil. The source was driven with a driving apparatus. The maximum velocity of the apparatus was ±300 mm/s in case of uniform acceleration, and ±30 mm/s in case of uniform velocity. The accuracy of velocity was within 0.5% in case of uniform velocity motion. The gamma-ray at 14.4 keV passed through a sample was detected with a scintillation counter. The velocity of the driving apparatus was calibrated by metallic iron of 12 μ thickness. The sample was made from 99.99% Fe_2O_3 + Cr_2O_3 adn Tb_4O_7. The internal magnetic field of $TbFe_{1-x}Cr_xO_3$ was measured. The temperature of the sample was varied from 5 to 300°K. It was found that Fe and Cr distributed uniformly over the sample of the mixed crystals of $TbFeO_3$ and $TbCrO_3$, and the internal magnetic field around Fe ions decreased when Cr ions came around them, and showed distribution according to the number of the Cr ions. The decrease due to the Cr ions is divided into the effect of decreasing hyperfine constant and the effect of decreasing the magnetic moment of Fe. The variation of the hyperfine constant is mainly due to supertransferred hyperfine field. It is considered that the sign of J_{Fe-Cr} is negative. The internal magnetic field of Fe^{3+} in $TbFeO_3$ was 550 kOe at T = 0°K, and that in $TbCrO_3$ was 516 ± 2 kOe. (JA)

10250 DETERMINATION OF DEFECT DISTRIBUTION IN SINGLE CRYSTALS BY CHANNELLING OF FAST CHARGED PARTICLES. Kudo, H.; Oshiyama, T.; Mannami, M. (Kyoto Univ.). J. Phys. Soc. Jap.; 36: No. 1, 214-220(Jan 1974).

Channelling of fast protons in silicon and germanium crystals with surface damaged layer was studied by backscattering method. The energy spectra of the backscattered protons can be interpreted by a theory based on the particle diffusion in the transverse momentum space. It is also demonstrated that the theory is applicable to the determination of the depth distribution profiles of the lattice defects in imperfect crystals. (JA)

10251 LAMINATED COMPOSITES OF REFRACTORY METALS AND OXIDES. Elssner, G.; Pabst, R.; Puhr-Westerheide, J. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Z. Werkstofftech.; 5: No. 2, 61-69(Mar 1974). (In German).

Laminated composites of the metals Nb, Nb-1 Zr, and Ta and of the oxides Al_2O_3 and ZrO_2 are manufactured by high-vacuum solid state bonding at temperatures above 1400°C without a formation of intermediate layers. Bulk molybdenum and alumina are joined together by means of a niobium layer. The combina-

tions investigated are of technical importance for the development of high temperature composites and refractory joints between metals and ceramics. The microstructure, the intrinsic chemical compatibility, and other properties of the composite samples are described. Moreover, a method based on fracture mechanics is described which characterizes the bond strength between metals and ceramics by means of K_{Ic}-factors. (GE)

10252 MAGNETIC MEASUREMENTS IN THE SYSTEMS (Zr,Hf)–(Fe,Co,Ni)–O. Sobczak, R. (Univ., Vienna). Monatsh. Chem.; 104: No. 6, 1526-1529(Nov 1973). (In German).

The phases Zr_3Fe, Zr_3CoO_x($x = 0.35:1$); Zr_3NiO_x($x = 0.2:1$); Hf_3NiO are measured magnetically in the range between 1300 and 90°K. Whereas Zr_3Fe is ferromagnetic, the other isotypical structures are paramagnetic. (auth)

10253 USE OF INFRARED SPECTROSCOPY FOR STUDY OF REDUCTION PROCESSES OF METAL OXIDES. Miroshnichenko, O. Ya.; Mombelli, V. V. pp 34-38 of Novye Metody Issledovaniya Protsessov Vosstanovleniya Tsvetnykh Metallov. Chizhikov, D. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From symposium on experimental methods for the study of ferrous and non-ferrous metals; Moscow, USSR (1 Nov 1971). See CONF-711158-.

The infrared spectroscopy method was used for the study of the oxides of V, Mn, W, and Fe during reduction. The infrared spectra of the oxides of these metals of different valencies and the spectra of WO_3 during different degrees of reduction in the range from 400 to 2000 cm^{-1} were obtained. The absorption bands for the valence oscillations and the lattice oscillations lie in the frequency range below 1000 cm^{-1}. The cubic structure oxides VO, MnO, and FeO and the metallic phases do not have absorption bands in this spectral region. The presence of very weak absorption bands in these spectra can be explained by the considerable defectness being generated by the lattice. By the infrared spectroscopy method the reduction processes developing in the fused systems were studied. In the spectra of the glass system V_2O_5–P_2O_5, bands were detected indicating V_2O_4. Bands of the chemical compound $mV_2O_4 \cdot nP_2O_5$ were also detected. Analysis of the spectra made it possible to detect complex compounds in the composition of which the reduction products of V_2O_5 were introduced. (tr-auth)

10254 USE OF ELECTRON PARAMAGNETIC RESONANCE (EPR) METHOD FOR STUDY OF REDUCTION OF OXIDES. Shul'man, V. G.; Chizhikov, D. M.; Tsvetkov, Yu. V.; Kazenas, E. K. pp 59-62 of Novye Metody Issledovaniya Protsessov Vosstanovleniya Tsvetnykh Metallov. Chizhikov, D. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From symposium on experimental methods for the study of ferrous and non-ferrous metals; Moscow, USSR (1 Nov 1971). See CONF-711158-.

WO_3 with additions of V_2O_5 was investigated by the EPR method. Samples of WO_3 with concentration of 10 mol % V_2O_5 were prepared from ammonia salts by two annealing regimes: 450°C for 2 h and 600°C for 7 h. A change of the EPR spectrum, caused probably by the sorption of unknown adsorbates, was detected. Results were explained under the assumption that the paramagnetic centers are V^{4+} ions arising in the deformed octahedral oxygen medium. (tr-auth)

10255 METHOD OF HIGH-TEMPERATURE CARBOTHERMAL REDUCTION OF OXIDES. Kiselev, V. A.; Vlasov, V. G.; Revebtsov, V. V. pp 105-106 of Novye Metody Issledovaniya Protsessov Vosstanovleniya Tsvetnykh Metallov. Chizhikov, D. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From symposium on experimental methods for the study of ferrous and non-ferrous metals; Moscow, USSR (1 Nov 1971). See CONF-711158-.

An installation for the high-temperature carbothermal reduction of oxides was described. The method for the study of the kinetics of the processes is gravimetric. The installation has a system of vertical transfer of samples, a system of horizontal transfer of sample containers, a spring microbalance, and a high-temperature furnace. The methodical characteristics of the reduction of the oxides ZrO_2, Nb_2O_5, and Ta_2O_5 were discussed. (tr-auth)

10256 INVESTIGATION OF HALL EFFECT IN OXIDE MELTS CONTAINING V_2O_5. Musikhin, V. I.; Lepinskikh, B. M.; Fomichev, Yu. A. pp 153-158 of Novye Metody Issledovaniya Protsessov Vosstanovleniya Tsvetnykh Metallov. Chizhikov, D. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From symposium on experimental methods for the study of ferrous and non-ferrous metals; Moscow, USSR (1 Nov 1971). See CONF-711158-.

The Hall effect and the thermoelectromotive force in oxide melts containing V_2O_5 were studied. Measurement of the Hall electromotive force was made in a constant magnetic field at temperatures of 750 to 1500°C. It was shown that the Hall constant decreases with increase of the temperature and reduction of P_{O_2}. (tr-auth)

10257 INFLUENCE OF SINTERING TEMPERATURE AND COOLING CONDITIONS UPON THE MICROSTRUCTURE AND THE RESIDUAL STRESSES IN WC–Co ALLOYS. Dubois, J.; Mai, C.; Riviere, R. (Institut National des Sciences Appliques, Villeurbanne, France). Z. Metallk.; 65: No. 2, 130-135(Feb 1974). (In French).

X-ray analyses combined with measurements of hardness and coercive force have shown the influence of sintering temperature and cooling rate after thermal treatment upon the microstructure and the residual stresses in WC–Co alloys with 6 wt % cobalt. Through the combined action of these two factors the continuity of the carbide phase in the structure can be decreased. Consequently, the residual stresses appear to be more homogeneous favoring compressive stresses. (GE)

10258 CERAMIC FUEL FABRICATION PROCESS PROVIDING CONTROLLED DENSITY AND GRAIN SIZE. Hill, H. H.; Kaznoff, A. I.; Marlowe, M. O. (to General Electric Co.). US Patent 3,803,273. 9 Apr 1974. Filed date 27 Aug 1971. 6p.

A method for fabricating ceramic fuel having controlled density and grain size is described. Ceramic powders of any given initial grain size are subjected to forming pressures to produce a structure of desired configuration followed by high temperature sintering to give controlled grain growth and to form a solid structure. The structure is then disintegrated by suitable means including a cyclic oxidation-reduction sequence to separate the grains along grain boundaries thus preserving the size and identity of the grains of the ceramic fuel. The grains are subjected to forming pressures to produce a structure of desired configuration and subjected to a high temperature sintering to achieve a solid body. The invention is applicable to ceramics such as uranium dioxide and other compounds of multivalent cations. (Official Gazette)

10259 TUNGSTEN ALLOY PRODUCTS. Dunham, T. E. (to General Electric Co.). US Patent 3,802,851. 9 Apr 1974. Filed date 1 May 1972. 8p.

Dispersion alloy products of tungsten are disclosed containing grain-growth promoting additives uniformly distributed in the tungsten matrix along with a concentration gradient of thoria particles. The thoria particles are distributed in the tungsten matrix so as to provide a compositional gradient which diminishes continuously with increasing distance from the exterior surface of the product to the product interior. In certain cases upon recrystallization of a wire product fabricated with the dispersion alloy material, there is also formed a central core of relatively large tungsten crystals and a shell of smaller more equiaxed crystals near the exterior surface portion of the particular product. In other embodiments, large interlocked grains were formed throughout the wire. Methods of producing these dispersion alloy products are also disclosed. (Official Gazette)

10260 STUDY OF BORIDE DEPOSITS. Application to the Deposition of Molybdenum and Tungsten Borides at the Hot Solar Front. Armas, B. (CNRS, Montlouis, France). Rev. Int. Hautes Temp. Refract.; 10: No. 4, 231-239(Oct 1973). (In French).

From meeting on solar furnaces and image furnaces; Odeillo-Font-Romeu, France (1 Oct 1971).

Molybdenum, tungsten, niobium, and tantalum borides have never been obtained in a satisfactory manner from the reduction of metallic halide and boron halide mixtures. Thermodynamic studies established the possibility of satisfactorily effecting the synthesis by thermally decomposing a suitable halide mixture. An experimental apparatus was developed. The metal and boride deposits obtained are described together with the characteristics and the results of different identification methods. (FR)

10261 STRENGTH OF BORONALUMINUM: A COMPOSITE WITH BRITTLE FIBERS. Mileyko, S. T.; Sorokin, N. M.; Tsirlin, A. M. (Inst. of Solid-State Physics, Moscow). Mekh. Polim.; No. 5, 840-846(1973). (In Russian).

A study was made of the failure of boron–aluminum, a composite material that is typical of the metal–brittle fiber class of materials. Dispersion-hardening D16 aluminum alloy served as the matrix. Two types of boron fibers (average strength 180 and 250 kg mm^2) were used for reinforcement. The best strength properties were found in specimens with the most uniform distribution of boron fibers. Conditions are formulated under which rupture in the composite can be prevented. (JPRS)

10262 ESR STUDIES OF RADIATION DAMAGE AND STRUCTURE IN OXIDE GLASSES NOT CONTAINING TRANSITION GROUP IONS: A CONTEMPORARY OVERVIEW WITH ILLUSTRATIONS FROM THE ALKALI BORATE SYSTEM. Griscom, D. L. (Naval

Research Lab., Washington, DC). J. Non-Cryst. Solids; 13: No. 2, 251-285(Jan 1974).

Electron spin resonance (ESR) is a particularly powerful method for identifying and characterizing radiation-induced defects in vitreous materials. The fundamental principles and the present state of the art in applying ESR techniques to achieve these ends in oxide glasses which do not contain transition group ions are reviewed. A wide variety of generic defect types are discussed in some detail by means of examples from the alkali borate system. These include oxygen-associated trapped hole centers and oxygen-vacancy-associated trapped electron centers, as well as several electron and hole-type centers which are associated with interstitial cations and anions, respectively. Probable analogs in other oxide glasses are pointed out. Special emphasis is placed on the kinds of structural information which can be obtained from these studies. (auth)

Metals and Alloys

Refer also to abstracts 9253, 10223, and 11872.

10263 (CONF-7209109-) PROCEEDINGS OF JAPAN-U. S. SEMINAR ON THE PHYSICAL METALLURGY OF HEAT RESISTING ALLOYS, DIAMOND POINT, NEW YORK, SEPTEMBER 13-15, 1972. (Japan Society for the Promotion of Science, Tokyo; National Science Foundation, Washington, D. C. (USA)). 1972. 222p.

Twenty-four papers were presented at the conference. A separate abstract was prepared for each of fifteen papers. Nine papers were considered outside of the scope of NSA. (JRD)

For abstracts of individual papers see: 10220, 10268-10270, and 10317-10327.

10264 (ORNL-4952) SOLID STATE DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1973. (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W-7405-eng-26. 164p. Dep. NTIS $7.60.

Results of research on solid state physics are presented in the areas of particle-solid interactions, electronic and magnetic properties, lattice dynamics, low temperature radiation effects, superconductivity, x-ray diffraction, electron microscopy, ion bombardment, surface properties, radiation damage, optical properties, spin resonance, and magnetic properties. (JRD)

10265 REDKOZEMEL'NYE METALLY SPLAVY I SOEDINENIYA. (Rare Earth Metals, Alloys, and Compounds. Seventh Conference Held at Moscow, USSR, September 12-17, 1972). Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). 355p. (In Russian, French, and English). (CONF-720978-).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972).

A separate abstract was prepared for each of fifty-two papers presented at the conference. (JRD)

For abstracts of individual papers see: 10229-10241, 10307, 10308, and 10336-10372.

Corrosion and Erosion

Refer also to abstract 9043.

10266 (AEC-tr-7527) BEHAVIOR OF CORROSION PRODUCTS IN WATER-STEAM SYSTEMS AT HIGH TEMPERATURES. Martynova, O. J. (USAEC Technical Information Center, Oak Ridge, Tenn.). 1972. Translation of pp 8-13 from the VGB Feedwater Conference, Essen, Germany, 1972. 22p. Dep. NTIS $3.25.

In thermal power plants, especially those with forced convection and 100% convection treatment, the behavior of corrosion products determines the water specifications of the plant. The degree of dispersion and solubility are discussed for such components as turbines and boilers, and experience with supercritical components in the Soviet Union is described. Deposition of Cu, Fe, and Si corrosion products is discussed. (DLC)

10267 (BARC-685) STRESS CORROSION CRACKING AND PASSIVITY IN BINARY Zr-Cr ALLOYS. Palit, G. C.; De, P. K.; Elayaperumal, K.; Balachandra, J. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 31p. Dep. NTIS (US Sales Only) $4.75.

Addition of chromium improves the resistance to stress corrosion cracking of annealed Kroll zirconium in a boiling solution of CH_3OH + 0.4% HCl. The time to failure by stress-assisted intergranular anodic dissolution increases by the addition of chromium. This beneficial effect is observed only when the added chromium is present in the form of the eutectoid α Zr + $ZrCr_2$. The occurrence of a well-defined hump in the cathodic polarization curve of a Zr-0.83% Cr alloy in the potential range -0.400 to -0.700 V is due to chromium-induced narrow range passivity in this potential range. (9 figures) (auth)

10268 (CONF-7209109-, pp 168-173) OXIDATION AND NITRIDATION OF Cr-W ALLOY. Matsumoto, T. E.; Shimotori, K.; Yebisuya, T. (Toshiba R and D Center, Kawasaki, Japan). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

The effects of W additions on oxidation and nitridation reactions in Cr alloys were investigated. Data and information on reaction rates and mechanisms are included. (JRD)

10269 (CONF-7209109-, pp 174-184) EFFECTS OF RARE EARTH ELEMENTS ON THE OXIDATION RESISTANCE OF IRON AND NICKEL BASE ALLOYS. Fukase, Y.; Osozawa, K.; Nemoto, R. (Nippon Yakin Kogyo Co. Ltd., Kawasaki, Japan). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

The effects of rare earth additions on the behavior of Si, Mn, and Al in 80 Ni-20 Cr and 20 Cr-32 Ni-Fe alloys were studied. It was found that oxidation resistance of the alloy with addition of rare earth elements is not improved by the formation of rare earth oxide itself but rather through indirect effects, i.e. by accelerating internal oxidation of Si, Al, and Mn and by making the surface chromium oxide more protective and tenacious. The effect of rare earth addition is pronounced only when it is added together with Si or Al. The beneficial effect of rare earth addition is observed in both iron base and nickel base alloys. (JRD)

10270 (CONF-7209109-, pp 185-196) TEST FOR FUEL OIL ASH CORROSION OF HEAT RESISTING ALLOYS. Miyagawa, O. (Tokyo Metropolitan Univ.). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

Results of tests to evaluate the resistance to fuel oil ash corrosion of stainless steels, alloy steels, and Inconel X are presented. Results are presented in terms of weight loss. (JRD)

10271 (IAEA-154, pp 325-366) COOLANT TECHNOLOGY AND CORROSION STABILITY OF CONSTRUCTION MATERIALS IN N_2O_4. Sukhotin, A. M.; Lantratova, N. Ya.; Trubinkov, V. P.; Atroshenko, E. I. (State Inst. of Applied Chemistry, Leningrad). 1973. (In Russian).

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The experimental results from a study of the corrosion stability of a wide variety of reactor construction materials in N_2O_4 were reported in graphic and tabular form. The corrosion rates were determined for the construction materials as a function of the time of contact, flow rate, pressure, and temperature. The construction materials studied were steels, Zr, W, V, Mo, Nb, Co, stellite, Sn, Ni, Al and Al alloys, and Ti and Ti alloys. The specifications for N_2O_4 to be used for reactor cooling are tabulated and discussed individually. (JSR)

10272 (SLA-73-1036) EFFECT OF INCREASING OXYGEN PRESSURE ON THE LUMINOSITY OF THE METAL-OXYGEN PHOTOFLASH REACTION. Nelson, L. S.; Northrup, C. J. M. Jr.; Wemple, R. P.; Richardson, N. L.; Keil, K.; Fastle, D. J.; Planner, H. N. (Sandia Labs., Albuquerque, N. Mex. (USA)). Mar 1974. Contract AT(29-1)-789. 91p. Dep. NTIS $7.75.

The metal wool-oxygen photoflash reaction was studied in separate experiments for equimolar quantities of zirconium, hafnium, aluminum and hydrided zirconium ($ZrH_{1.4}$) in oxygen at pressures from 1 to 125 atmospheres. The luminous emission was studied with photomultiplier and calibrated photographic spectroscopic techniques. The reactions were photographed with a high speed camera and the solid products were analyzed by optical microscopy and electron microprobe techniques. The light emitted in the zirconium-oxygen photoflash reaction increases in peak intensity (2-fold in the red to 4.5-fold in the blue), and decreases in pulse width and pulse assymetry as the oxygen pressure is increased from 1 to 100 atmospheres. At the same time, the average peak brightness temperature increases from about 3600°K to 4400°K. The emission approximates a blackbody to within ±3% even at the highest pressures, but the apparent temperature falls considerably below that predicted by the vapor pressure/temperature relationships given by Krieger. The luminosities of the hafnium, aluminum, and zirconium hydride ($ZrH_{1.4}$) reactions are about 10-fold lower than those of the zirconium-oxygen photoflash reaction on an equimolar basis. In an appendix, the combustion of the zirconium wool in gaseous nitrogen is shown not to occur at pressures up to 100 atmospheres. (auth)

10273 (SLL-74-5213) PROTECTIVE COATINGS FOR URANIUM ALLOYS. Weirick, L. J. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Apr

1974. Contract AT(29-1)-789. 85p. (CONF-740205-11). Dep. NTIS $7.25.

From conference on physical metallurgy of uranium alloys; Vail, Colorado, USA (12 Feb 1974).

A review is presented on the use of protective coatings for improvement of the corrosion resistance of uranium alloys. The discussion includes a "state-of-the-art" review of coatings on unalloyed uranium. The coatings considered include protective oxides, organic films and metallic platings. The primary uranium alloys discussed in this review approximately in order of increasing chemical nobility are: U–¾ Ti, U–2¼ Nb, U–¾ Mo–¾ Nb–¾ Zr–½ Ti (Quad · ¾), U–¾ Mo–¾ Nb–¾ V–¾ Zr–½ Ti (Quint · ¾), U–4½ Nb, U–6 Nb, U–8 Nb, U–7½ Zr–2½ Nb (Mulberry), and U–10 Mo. The primary coating candidates considered in order of increasing nobility are: zinc, cadmium, aluminum, and nickel. The four environments typically used for corrosion testing on these uranium alloys are: humid air, boiling water, dilute salt solutions, and ocean water. The most common measurements made to compare the corrosion resistance of the materials and their coatings were weight changes. Electrochemical measurements were useful in determining whether or not the coating imparted galvanic protection to the alloy. A recently developed electrochemical technique is shown to be applicable to determination of the integrity of coatings on uranium alloys. The effect of coatings on the stress corrosion cracking susceptibility of uranium alloys is also discussed. A brief description of the technical details of the plating processes is included. (20 fig, 13 tables, 53 references) (auth)

10274 STRESS CORROSION CRACKING BEHAVIOR OF URANIUM ALLOYS. Czyrklis, W. F.; Levy, M. (Army Materials and Mechanics Research Center, Watertown, MA). Corrosion; 30: No. 5, 181–187(May 1974).

The stress corrosion cracking (SCC) behavior of U–¾% Ti, and uranium alloys ¾% Quad, 1% Quad, and 1% Quint was studied utilizing a linear elastic fracture mechanics approach. (Quad is an alloy containing ≤1% each of Mo, Nb, Zr and Ti; Quint, ≤1% of Mo, Nb, Zr, Ti, and V.) The threshold stress intensities for stress corrosion crack propagation for these alloys were determined in distilled H_2O and NaCl solutions containing 50 ppM Cl^- and 21,000 ppM Cl^-. All of the alloys studied may be classified as very susceptible to SCC in aqueous solutions since they exhibit SCC in distilled H_2O (<1 ppM Cl^-) and have low K_{Iscc} values in NaCl solutions. Crack extension in all of the alloys in all environments was transgranular and failure occurred by brittle quasicleavage fracture in NaCl solution. (10 figures) (auth)

10275 EFFECT OF RELATIVE HUMIDITY ON THE STRESS CORROSION CRACKING OF U–7.5 Nb–2.5 Zr ALLOY. Miller, A. R. (New Mexico Inst. of Mining and Tech., Socorro). Corrosion; 30: No. 5, 177–178(May 1974).

Stress corrosion (SC) of Mulberry in vapors of sulfuric acid–water and glycerine–water solutions was studied for relative humidities (RH) from 0 to 100%. Results show that water vapor plays a complicated role; there may be two separate SC mechanisms, one optimized by water, the other by its absence, so that at midrange RH values, SC is minimized. (DLC)

10276 EFFECT OF ALLOYING ADDITIONS ON THE PITTING RESISTANCE OF 18% Cr AUSTENITIC STAINLESS STEEL. Brigham, R. J.; Tozer, E. W. (Endako Mines, Ottawa). Corrosion; 30: No. 5, 161–166(May 1974).

Using temperature as a pitting criterion, the effects of Mo and other supplementary alloying additions on the pit initiation resistance of wholly austenitic stainless steel containing nominally 18% Cr were evaluated. Quantitative results for Mo, Cu, Ni, Mn, N, and Si alloy additions are presented and empirical relationships are given which describe the pitting resistance of several families of alloys. Both experimental and commercial alloys were evaluated. (auth)

10277 ELLIPSOMETRIC MEASUREMENTS OF THE PLASMA OXIDATION OF Nb AND Ta AND THEIR INTERPRETATION. Knorr, K. (Institut Max Von Laue-Paul Langevin, Grenoble, France); Leslie, J. D. J. Electrochem. Soc.; 121: No. 6, 805–808 (Jun 1974).

Ellipsometric results are presented showing that it is possible to grow a uniform Nb oxide film by plasma oxidation, and the index of refraction of this Nb oxide is 2.30. Similarly, in a previous paper it was shown that plasma oxidation of Ta produced a uniform Ta oxide film with a refractive index of 2.21. These results are in contrast to the earlier work of [Lee et al., J. Electrochem. Soc. 117: 1172(1970)] who fitted their ellipsometric measurements on the plasma oxidation of Nb and Ta with two-layer models. It is shown that the Nb and Ta oxides in the work of Lee et al. were not grown to a sufficient thickness to prove definitively that the oxides were composed of two layers, and that their data can be fitted equally well with one-layer models. (auth)

10278 RETENTION OF FLUORINE BY SILICON SURFACES: INTERACTION WITH GOLD-REFRACTORY TRANSISTOR METALLIZATIONS. Day, H.; Christou, A.; Bressan, D. J. ((Naval Research Lab., Washington, DC). J. Electrochem. Soc., 121: No. 6, 790–792(Jun 1974).

The interaction of gold-tantalum transistor metallizations with silicon substrates has been studied as a function of fluorine ion contamination. An NH_4F buffered etch solution tagged with 118-min half life ^{18}F was used to quantitatively establish the fluorine contamination as a function of water rinse time and evacuation time before metal deposition. Pinhole formation in the refractory layer due to fluorine ion contamination with a subsequent rapid interdiffusion of gold and silicon during a 300°C anneal was shown to be a probable failure mechanism for transistors. (auth)

10279 EFFECT OF OXYGEN, CHLORIDE ION, AND WATER VAPOR ON CRACK INITIATION OF U–7.5 Nb–2.5 Zr (Mulberry). Weirick, L. J.; Schoenfelder, C. W. (Sandia Lab., Livermore, CA). Corrosion; 30: No. 5, 169–174(May 1974).

The susceptibility of Mulberry to the initiation of stress corrosion cracking (SCC) was studied. Results show that where the chloride ion is present in concentrations of less than 2 ppM, a smooth bend specimen with or without a nickel couple subjected to maximum stress near its yield point does not exhibit crack initiation during a 3-year period. Crack initiation is prevented in a chloride environment if available oxygen is reduced to a very low but undeterminable value. (4 tables, 5 fig) (auth)

10280 CHEMICAL ASPECTS OF CORROSION AND MASS TRANSFER IN LIQUID SODIUM. Proceedings of the Symposium Held at Detroit, Michigan, October 19–20, 1971. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973). 424p. (CONF-711084-).

Twenty-one papers and discussions are presented of the state-of-the-art of this topic which is relevant to the LMFBR program. Separate abstracts have been prepared for all the papers and discussions. (DLC)

For abstracts of individual papers see: 9135–9138 and 10281–10297.

10281 SODIUM CORROSION BEHAVIOR OF ALLOYS FOR FAST REACTOR APPLICATIONS. Whitlow, G. A.; Cwynar, J. C.; Miller, R. L.; Schrock, S. L. (Westinghouse Nuclear Energy Systems, Madison, PA). pp 1–63 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Sodium loop corrosion studies were performed on austenitic steels, a number of nickel alloys, and on one cobalt base alloy at temperatures between 1025 and 1325°F. This paper summarizes the observations on structural, compositional and hardness changes in the alloy surface layers which result from exposure to sodium in hot leg material removal areas. For the austenitic 304 and 316 steels, the most pronounced effect is the change from an austenitic to a ferritic surface layer. Variations in depletion depth and compositional gradients near the surface allowed the calculation of chromium diffusion coefficients in the austenitic phase. Inconel 600 exhibited intergranular corrosion in both low (<10 ppM) and high (20–25 ppM) oxygen sodium at 1325°F, while Incoloy 800 exhibited intergranular attack in high-oxygen sodium only. Stellite 6 showed more uniform corrosion. An iron-rich layer deposited on Stellite 6, Inconel 600 and Inconel 606 in high-oxygen sodium. Compositional and hardness gradients on Stellite 6 showed an excellent correlation, with the hardness of the surface layer considerably lowered as the chromium level of the alloy decreased and as the levels of iron, nickel and cobalt increased. (35 fig., 33 references) (auth)

10282 MICROSTRUCTURAL AND COMPOSITIONAL CHANGES IN SODIUM-EXPOSED STAINLESS STEEL BY SCANNING ELECTRON MICROSCOPY. Berkey, E. (Westinghouse Research Labs., Pittsburgh); Whitlow, G. A. pp 65–99 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Sodium corrosion and mass transport effects in several coupled Type 316–304 stainless steel loop systems were studied using the combined observational and analytical advantages of a scanning electron microscope with an associated energy-dispersive x ray

spectrometer. Microstructural and compositional changes on the sodium-exposed surface of the steels were established for both material removal and material deposition zones using a newly developed data reduction procedure. X-ray diffraction analysis was employed to supplement the elemental identifications. Primary emphasis was placed on a loop operated for 10,000 hours under prototypic primary loop conditions for a first generation fast breeder reactor but some comparisons with loops operated under other conditions have also been made. (15 fig.) (auth)

10283 MASS TRANSPORT OF STAINLESS STEEL CORROSION PRODUCT IN FLOWING LIQUID SODIUM. Claxton, K. T.; Collier, J. G. (United Kingdom Atomic Energy Authority, Harwell, Eng.). pp 101-129 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

The mass transport of corrosion products likely to be encountered in a fast reactor through exposure of stainless steel to flowing liquid sodium is being studied. A pumped sodium loop capable of flow rates of 1100 kg hour^{-1} at a temperature of 600°C was commissioned. This rig incorporates an indirectly heated radioactive cylindrical test section and cold trapping and filtering facilities. It is designed to simulate certain features of both a fast reactor heat exchanger and a reactor purification circuit. The first experiments have investigated the transport and deposition characteristics of ^{59}Fe and ^{54}Mn. The iron behavior is characterized by its appearance as a deposit immediately downstream of the test section. The deposit is nonuniform, consisting of peaks and totally bare parts within distances of a few mm. Auger spectroscopy reveals an interesting constancy in the proportions of Na, Fe, and O through the deposit. Cameca direct imaging mass analysis has revealed the presence of several other mass numbers including chromium within the deposit and has also indicated penetration of the iron into the base metal. ^{54}Mn transport was characterized by preferential migration to the diffusion cold trap. A decontamination procedure was developed which adequately removes the iron and manganese deposits without affecting the base metal. (2 fig.) (auth)

10284 THERMODYNAMICS OF CARBON TRANSFER IN SODIUM-STEEL SYSTEMS. Natesan, K.; Kassner, T. F. (Argonne National Lab., IL). pp 130-155 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Data for the activity and solubility of carbon in austenitic stainless steels and sodium were used with phase-equilibria information to obtain an equilibrium relationship between the carbon concentration in the alloy and that in sodium at temperatures between 500 and 800°C. At the lower temperatures, the carbon concentrations in sodium in equilibrium with austenitic stainless steels of nominal carbon contents are 1 to 2 orders of magnitude lower than our prior estimates; i.e., 0.04 ppM at 700°C and 0.003 ppM at 600°C. The carbon distribution values and data for the diffusion of carbon in stainless steel were used to determine an "effective" driving force for carburization and decarburization of the steel in sodium as a function of temperature at carbon concentrations of 0.01 and 0.1 ppM in sodium. Activity–concentration relationships for carbon in Fe–Cr–8 wt % Ni alloys with zero to 22% chromium, and data on the distribution of carbon between alloys containing zero and 18% chromium from CH_4/H_2 gas and flowing sodium equilibrations are presented which lend credibility to the computations. (15 fig.) (auth)

10285 INTERSTITIAL MASS TRANSFER IN SODIUM SYSTEMS. Shiels, S. A.; Bagnall, C.; Schrock, S. L. (Westinghouse Nuclear Energy Systems, Madison, PA). pp 157-176 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Empirical studies of carbon and nitrogen transfer in sodium systems are under way. Use is made of the Material Test Loops (MTL's) which are designed to reproduce corrosion kinetics in LMFBR primary and secondary systems. These loops are destructively evaluated for carbon and nitrogen movement at the end of each system's simulation run. Evaluation is carried out by comparing carbon and nitrogen profiles through the containment walls with similar profiles from as-received material. Evaluation of primary system loops (316 hot leg, 304 cold leg) has shown that both carbon and nitrogen are lost from the high-temperature regions of the system and deposited either elementally (for carbon) or in combination with other elements in the areas of decreasing temperature and in the cold leg regions. Surface values less than 100 ppM by weight have been observed at the outlet of the heater section (corresponds to 1325°F cladding hot spot) for both carbon and nitrogen with depleted depths of up to 30 mils. High carbon and nitrogen levels in the cold leg regions up to 1200 ppM are attributed to surface deposits. There is no evidence to indicate that the carbon and nitrogen diffuse into cold leg components. Metallographic evidence for interstitial depletion in the hot leg regions and deposition in the cold leg regions is also obtained. (9 fig.) (auth)

10286 FUNDAMENTAL ASPECTS OF CARBURIZATION AND DECARBURIZATION OF CHROMIUM STEELS IN SODIUM SYSTEMS. Goldmann, K.; Kolodney, M.; Arbiter, W.; Stern, G. (Gulf United Nuclear Fuels Corp., Elmsford, NY). pp 177-197 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Carburization and decarburization are described on the basis that they are controlled by kinetic processes and the thermodynamic activities of carbon in the steel and sodium. In general in the steel, these processes involve diffusion accompanied by phase change so that a simple model of homogeneous diffusion is not applicable. It is essential to consider the solubility of carbon, the nature of the carbides formed, and the activity of carbon in their presence. The literature on carbon solubility on both austenitic and ferritic chromium steels is reviewed and it is shown that solubilities are very low, so that precipitated carbides are usually present. The nature of these carbides and their effect on carbon activity are described. The diffusivity of carbon in ferritic and austenitic steels is reviewed. It is shown that diffusivity calculated from total carbon contents rather than from carbon in solution has led to serious misinterpretation of the kinetics of the transport of carbon. A general model for the transport of carbon is presented. This involves its motion in the steels and the effects of the sodium coolant and its temperature. (79 references) (auth)

10287 INTERSTITIAL ELEMENT MOVEMENT IN POTENTIAL FUEL CLADDING MATERIALS IN SODIUM. Grosser, E. D. (INTERATOM, Cologne). pp 199-206 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer, in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Results obtained from the current sodium corrosion program of the SNR consortium show changes of the interstitial elements of potential fuel cladding materials. A review is given on the movement of N, B, and C of the German potential fuel cladding materials, when exposed to flowing sodium between 600 and 730°C. The materials are 1.4981, 1.4988, and 1.4970 stainless steels. The data, especially on N and B, is of a preliminary nature. (5 fig.) (auth)

10288 GENERAL MODEL FOR THE CORROSION OF STEELS IN HIGH VELOCITY SODIUM. Weeks, J. R.; Isaacs, H. S. (Brookhaven National Lab., Upton, NY). pp 207-222 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

The experimentally observed corrosion behavior of steels in liquid sodium is summarized with respect to the effects of time, oxygen, sodium velocity, system geometry, and temperature. A model is proposed for the corrosion of stainless steels in high-velocity sodium from which a corrosion equation is developed. This equation is shown to agree quantitatively with experimental results obtained from several sources at 650 to 760°C and 3 to 30 ppM oxygen. (9 fig.) (auth)

10289 MODEL FOR THE DOWNSTREAM EFFECT IN THE CORROSION OF STEELS BY LIQUID SODIUM. Isaacs, H. S.; Romano, A. J.; Klamut, C. J.; Weeks, J. R. (Brookhaven National Lab., Upton, NY). pp 223-231 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A.

(ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

The downstream effect in the corrosion of stainless steel by liquid sodium is a reduction in the steady-state corrosion rate with distance along an isothermal, maximum temperature section of the sodium circuit. The corrosion rate of iron is considered to be controlling the overall corrosion rate of the steel. The downstream effect is attributed to the adsorption of chromium and nickel that dissolved upstream of a given specimen on the active sites for dissolution for iron from the specimen. Insertion of a nickel specimen in a corrosion test section was observed to reduce the corrosion rate of all specimens further downstream in the circuit, as predicted by the model. (auth)

10290 ROLE OF PARTICULATES IN THE CORROSION OF STEELS BY LIQUID SODIUM. Wachtel, S. J.; Romano, A. J.; Klamut, C. J.; Isaacs, H. S.; Weeks, J. R.; Gurinsky, D. H. (Brookhaven National Lab., Upton, NY). pp 232-240 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Removal of particulates from the sodium by filters in series with impingement and magnetic traps reduced the steady state concentrations of Fe, Cr, and Ni in grab samples of the sodium. The corrosion rate in the rising temperature region was unchanged, but the corrosion rate in the downstream region was increased, in agreement with the model proposed by Isaacs et al. for the downstream effect. Computer calculations of the corrosion rate, using a velocity-dependent model with a "source term" to represent the effect of the particles, indicate that, for the "source term" to be sufficiently effective in reducing the corrosion rate from values calculated from the available solubility data, to the observed levels, corrosion in the downstream region would reach zero in the first 50 L/D of the isothermal section. Therefore, suppression of the rate of corrosion by particulates dispersed in sodium does not resolve the apparent discrepancy between the measured rates and those calculated from solubility data, as previously supposed. (auth)

10291 SOME CONSEQUENCES OF THE MAINTENANCE OF EQUILIBRIUM OF ALLOYING CONSTITUENTS BETWEEN THE SURFACE OF STAINLESS STEEL AND SODIUM IN A RECIRCULATING SYSTEM. Draley, J. E. (Argonne National Lab., IL). pp 241-252 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

A theoretical analysis is made of dissolution, transport, and deposition of the alloying constituents of stainless steel in sodium recirculating in a temperature-gradient system. Attention is on the special case, called quasi-equilibrium, in which the activities of the alloying constituents are maintained in the alloy surface, by deposition or dissolution, equal to their chemical activities in contiguous sodium. Diffusion in the solid alloy is neglected. Surface composition and rates of dissolution and deposition are shown to depend on loop position and on the chosen values of the "effective solubilities" that determine the activities of the alloying constituents in the sodium. The efficiency with which precipitated solids deposit is shown to influence the quantity of suspended solid in the sodium, the rates of dissolution, and the uniformity of the deposits. (9 fig.) (auth)

10292 EXPRESSION FOR MONOMETALLIC CORROSION RATE IN LIQUID SODIUM. Kolster, B. H.; Bogers, A. J. (Metaalinstituut TNO, Delft, Netherlands). pp 253-264 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Expressions for the rate of metal loss are derived for the oxygen-independent (e.g., Ni) as well as for the oxygen-dependent (e.g., Fe) corrosion process in liquid sodium. The more complicated equation for the latter corrosion process, treated as a first-order reaction with respect to oxygen, expresses the corrosion rate as a function of temperature, sodium velocity, specimen geometry, isothermal downstream position and oxygen concentration. The first confrontation with experimental results for stainless steel is in favor of the model. However, the assumed first order with respect to oxygen does not fit the experimental results. Moreover, there is an obvious discrepancy between the magnitude of the corrosion rate and the oxygen level measured, in connection with a substantial isothermal downstream effect. This discrepancy can be explained by assuming that the corrosion rate process is determined by the amount of active oxygen, being a small fraction, about 10^{-5}, of the total amount of oxygen compound present in the sodium (e.g., $NaCrO_2$). Although this is merely a hypothesis, it does explain a measured order not equal to one, resulting in the conclusion that the measured order and the actual order in the iron–oxygen reaction (according to the model) are not necessarily the same. (auth)

10293 RELATIONS BETWEEN CORROSION TEST RESULTS AND A POSSIBLE MECHANISM OF LIQUID SODIUM CORROSION. Borgstedt, H. U.; Frees, G. (Nuclear Research Center of Karlsruhe, Ger.). pp 265-277 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

The liquid sodium corrosion of stainless steels seems to be based upon oxygen exchange reactions between the sodium and the components of austenitic stainless steels. In loop tests some phenomena were observed that may support the proposed mechanisms. Experiments with sodium of varying oxygen content indicated that weight losses from stainless steels were prevented at oxygen levels below 0.2 ppM. Corrosion rates of nickel specimens tested in parallel were unaffected by the oxygen concentration in the range 0.2 to 5 ppM. A downstream effect was observed. Intergranular corrosion was found to involve precipitation of oxides and carbides of Nb or Ta, formation of complex oxides of sodium and niobium or tantalum, and the dissolution of these oxides. Continuous measurements of oxygen activity in the sodium circuit have demonstrated a consumption of oxygen, which is related to oxygen-consuming corrosion reactions in the high-temperature region of the loop. (6 fig.) (auth)

10294 CORROSION BEHAVIOR OF FERRITIC STEELS IN FLOWING SODIUM. Sannier, J.; Konovaltschikoff, O.; Leclercq, D.; Darras, R. (CEN, Fontenay-aux-Roses, France). pp 278-298 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

The long-term behavior in flowing sodium of some ferritic steels with different chromium contents was investigated at temperatures between 475 and 650°C, in order to estimate the possibility of using such steels as component materials of steam generators for fast reactors. The tests were carried out in an austenitic steel loop. At all temperatures considered, the ferritic steels containing 2.25 to 9% chromium show very low dissolution rates: after more than 6000 hours exposure, the weight losses are less than 1 mg cm^{-2}, even at 650°C. In addition, the corrosion rates, which are dependent on the initial surface conditions for the first few thousand hours of exposure, continue to decrease with time. A surface etching phenomenon, due to preferential dissolution at the grain boundaries, occurs at 650°C. From the standpoint of decarburization, all the ferritic steels, including 2.25% Cr unstabilized, show a satisfactory behavior at 475°C. At 550°C, 2.25% Cr unstabilized steel is decarburized, whereas 2.25% Cr niobium stabilized steel does not lose carbon. A 9% chromium–iron alloy has excellent resistance up to 650°C. The mechanical properties of ferritic steels remain practically unchanged after 6000 or even 10,000 hours exposure at 475°C. Above this temperature, the variations observed should be ascribed to the corresponding heat treatment rather than to the action of sodium itself, except when deep decarburization occurs. (18 fig.) (auth)

10295 COMPOSITIONAL CHANGES IN AUSTENITIC STEELS AFTER CORROSION IN SODIUM AT 700°C. Baque, P. A.; Champiex, L. J.; Honorat, E. T. (CEN, Cadarache, France). pp 299-316 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Samples of 304 L, 316 L, 318, 321, and 316-Ti stainless steels

were exposed in three parallel channels of a pumped loop. Experimental conditions were: sample temperature, 700°C; temperature gradient, 500°C; sodium velocity, 2 ms^{-1}; cold trap temperature, 110°C. Various exposure times were between 1,000 and 10,000 hours in order to obtain kinetic results. Identical samples are exposed under vacuum at the same temperature for the same lengths of time. As early as after 1,000 hours, significant differences in weight change are noted between the various types of austenitic steels. Similarly, electron microprobe examinations near the sodium exposed surface show compositional changes which are distinct for each steel. Microstructural aspects are also different. Comparisons between weight change kinetics and surface compositional and structural changes allow some comments and assumptions to be drawn regarding the importance of metallic diffusion and the influence of such elements as Mo and Ti. (13 fig.) (auth)

10296 CHEMICAL COMPOSITION OF CORROSION PRODUCTS IN LIQUID SODIUM. Barker, M. G.; Wood, D. J. (Univ. of Nottingham, England). pp 365-379 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Several corrosion products on the surface of metals exposed to static sodium containing dissolved oxygen were identified by x-ray powder diffraction of the metal surface recorded through a matrix of sodium. A parallel study of the reactions of metal oxides with liquid sodium and the solid state reactions of sodium oxide with the metal under vacuum enabled the preparation and characterization of the corrosion products to be established. Many of the metals showed lattice expansion after immersion in sodium and measurement of the lattice constant enabled the extent of oxygen solid solution to be calculated. The following compounds were identified as corrosion products on the surfaces of the relevant transition metals: Na_3NbO_4, Na_3TaO_4, Na_4VO_4, Na_4TiO_4, Na_2ZrO_3, ZrO_2, $NaCrO_2$, and Na_4FeO_3. (7 tables) (auth)

10297 EXPERIMENTAL STUDY OF MASS TRANSFER AND ALLOYING BEHAVIOR OF METALS IN LIQUID SODIUM. Berlin, B. (Aktibolaget Atomenergie, Studsvik, Sweden). pp 403-419 of Chemical Aspects of Corrosion and Mass Transfer in Liquid Sodium. Jansson, S. A. (ed.). New York; Metallurgical Society of the American Inst. of Mining, Metallurgical, and Petroleum Engineers, Inc. (1973).

From chemical aspects of corrosion and mass transfer in liquid sodium symposium; Detroit, Michigan, USA (19 Oct 1971). See CONF-711084-.

Powder samples of Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Nb, and Mo and certain combinations thereof were heated with liquid sodium in stainless steel rocking autoclaves at temperatures up to 700°C. After cooling of the autoclaves and removal of the sodium, x-ray and chemical analyses were performed on material that remained in the autoclave. Metallographic sections were also prepared of the autoclave body. Deposits formed during the experiments or upon cooling were characterized. Of particular interest are the observations of alloy deposits which in at least one case were layered. With Cu only the pure, well-crystallized metal deposited on the autoclave wall. Powder mixtures of Fe and Ni gave $FeNi_3$, Fe, Ni, and solid solution of Fe in Ni depending on the ratios of these metals initially added. The rocking action enhanced the kinetics of reaction. Comparative experiments on alloy mixtures without the sodium illustrated the important roles of sodium as a mass transfer medium and as an activating agent, probably through the reduction of oxide films on the particle surfaces. (10 fig., 4 tables) (auth)

10298 TEMPERATURE INFLUENCE ON CORROSION FATIGUE BEHAVIOR OF 5Ni-Cr-Mo-V STEEL. Ryder, J. T. (Lockheed-California Co., Burbank); Gallagher, J. P. J. Test. Eval.; 2: No. 3, 180-189(May 1974).

An investigation of the below K_{Iscc} corrosion fatigue crack propagation behavior of 5Ni-Cr-Mo-V steel in a 3½% NaCl environmental solution is conducted with particular emphasis on the influence of frequency and temperature. The behavior is described using a generalized equation which incorporates the influence of temperature, frequency, and stress intensity range. The generalized equation $(da/dN)|_c = (da/dN)|_F\ |H(\Delta K, f, T)|$ relates the corrosion fatigue crack growth rate, $(da/dN)|_c$, to the baseline cycle-dependent fatigue crack growth rate, $(da/dN)|_F$. The function H is an environmental enhancement multiple. The severity of the temperature influence on environmentally enhanced fatigue crack growth rates of steels in aqueous environments appears to be related to the inherent resistance of the material to environmental cracking. (auth)

10299 INFLUENCE OF SOME ALLOYING ELEMENTS ON VANADIUM CORROSION OF HIGH-TEMPERATURE ALLOYS. Cihal, V. Strojirenstvi; 22: No. 5, 294-296(1972).

Vanadium corrosion caused by combustion products from petroleum fuels is a frequent cause of breakdowns in gas turbines, and also in chemical plant and steam generators. The influence of alloying elements on the corrosion resistance of a number of materials was studied. (Corros. Abstr.)

10300 CONTRIBUTION TO THE METALLOGRAPHIC STUDY OF THE INITIAL STAGES OF HAFNIUM OXIDATION. Pieraggi, B.; Dabosi, F. Compt. Rend., Ser. C; 274: No. 13, 1256-1259 (1972). (In French).

10301 PROTECTION OF NIOBIUM AGAINST OXIDATION. Kanter, J. J. US Patent 3,802,929. 9 Apr 1974. Filed date 7 Feb 1972. 6p.

Niobium is provided with a surface barrier by forming an oxide layer of Nb, complexing the oxide layer with a Group III metal, and then oxidizing the Group III metal, for example, by treatment with phosphoric acid. (Official Gazette)

10302 CORROSION OF PURE METALS IN MOLTEN VANADIUM PENTOXIDE. Muroi, S. I.; Someno, M. Trans. Iron Steel Inst. Jap.; 13: vp(1973).

A study was made of the corrosion behavior of iron, cobalt, zirconium, titanium, nickel, and chromium in V_2O_5 melt. Three types of oxidation law were found: accelerated, linear, and logarithmic. Linear rate law at the initial stage and the causes of the accelerated oxidation of iron and cobalt in V_2O_5 melt were discussed. (Corros. Abstr.)

10303 LEED-AUGER STUDY OF OXIDE FORMATION AT 650 TO 1100K. Avery, N. R. (Melbourne Univ., Parkville, Australia). Surface Sci.; 41: No. 2, 533-546(Feb 1974).

The nucleation and growth of oxide crystals on a W(110) surface in the temperature range 650 to 1100°K has been studied by Leed and Auger electron emission. Above 100°K WO_3 (11$\bar{1}$) crystals, faceted to expose {100} surfaces, are formed. At 850°K, WO_3 (100) crystals in two rotational domains coexist with faceted WO_3 (11$\bar{1}$). At 650°K, no faceted WO_3 (11$\bar{1}$) is formed, but instead an oxide giving an incoherent Leed scatter coexisted with WO_3 (100). The oxide resulting in the incoherent scatter could be annealed at 1050°K to unfaceted WO_3 (11$\bar{1}$). The Leed patterns due to oxide were optimumly developed when the surface was just covered by oxide and further oxidation produced an incoherent scatter. A model for the nucleation of oxide from a precursor state formed at ridges in the substrate surface and growth of the bulk crystal is proposed. Changes in surface composition during incremental flash desorption were studied by Auger spectroscopy. A 2.85 fold increase in the tungsten Auger signal when the thick oxide was flashed off is consistent with the oxide being WO_3. (auth)

10304 OXIDATION OF SUPERHEAT MATERIALS IN STEAM: 12Cr FERRITIC STEELS AND NICKEL-RICH ALLOYS. Board, J. A. (British Nuclear Design and Construction Ltd., Whetstone, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 2, 211-216(Apr 1974).

Results are reported of steam corrosion tests on the 12% Cr steels 405, 406, and 410, Nimonic PE16, Nimonic 80A, Inconel 600, Incoloy 800, Hastelloy F, and Hastelloy X. Tests were conducted in both atmospheric-pressure and high-pressure rigs. Weight-gain/time curves are shown for tests in 550, 650, and 750°C steam, together with the results of microexamination. The results are discussed and it is concluded that 12% Cr steels exhibit non-protective oxidation but this can be modified in the short-term by cold work at the surface and by Al additions. Si content may also influence the short-term corrosion behavior. For Ni-rich alloys, high Cr content is the most important factor for the formation of protective oxides. Incoloy 800 shows good resistance in steam at 550°C and above, but it and other Ni-rich alloys are susceptible to formation of grain boundary carbide networks at these temperatures. Cr depletion may also occur. (UK)

Preparation and Fabrication

Refer also to abstracts 9130, 9139, 10251, and 10576.

10305 INVESTIGATION OF THE PRESSING PROCESS OF TUNGSTEN FIBRES. Meerson, G. A.; Kiparisov, S. S.; Khocholava, Z. D. (Inst. of Metallurgy, Tbilisi, USSR). Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 7-11(Apr 1974). (In Russian).

The composite material copper-tungsten fiber and the problem of production of the wire frame by means of pressing the fibers are considered. The dependence of the wire frame density on pressing pressure was investigated both in the mold under loading and after discharge. By means of mathematical processing of experimental data on pressing ability of tungsten fibers, the values of the coefficients k and b in the equation $\lg P = k \lg \theta + b$ are

estimated. The values of coefficients for parallel and arbitrary oriented fibers are determined. (auth)

10306 USE OF ATOMIC ABSORPTION FOR CONTROLLING SOLDERING DEPTH DURING SOLDERING BY ELECTRON BOMBARDMENT. Heintz, L.; Le Meur, J. (CEA, Montrouge, France). pp 727-742 of Atomic Absorption and Atomic Fluorescence Spectrometry. Vol. 2. New York; John Wiley and Sons, Inc. (1973). (In French).

From third international congress of atomic absorption and atomic fluorescence spectrometry; Paris, France (27 Sep 1971). See CONF-710992-P2.

This checking aims to ascertain whether a solder made by electron bombardment has reached a minimum depth necessary for a good mechanical strength of the assembly. The principle is the following: a layer of tracer metal is laid at the minimum depth to be reached. If the molten portion reaches this depth, it leads to melting and volatilization of the tracer, which appears then into the plasma occurring above the point of impact of the electron beam. The tracer is detected by using the atomic absorption method. Tests and development of the checking conditions have been carried out on the following types of solders: deep non-penetrating soldering of uranium–vanadium plates; transverse soldering of thin stainless steel plates; and deep non-penetrating soldering of AG5 plates. (auth)

10307 THERMOCHEMICAL HIERARCHIES IN CERTAIN BINARY COMPOUNDS OF TRANSITION ELEMENTS. Application to the Preparation of Rare Earth Metals. Trombe, F.; Male, G. pp 15-26 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In French)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–

The double behavior of rare earth metals i.e., the formation of stable compounds and the formation of compounds from which the rare earths are easily displaced is examined. Studies of the latter leads to the description of a new method for the preparation of rare earth metals. The position of the rare earths in the thermochemical hierarchy of different binary compounds oxides, sulfides, nitrides, and carbides is examined. The preparation method is based on the displacement of the rare earths from their carbides by a very non-volatile metal. The method is applicable to all the rare earths except the most volatile (Sm, Eu, and Yb) and gives a high-purity metal with excellent yield. (JSR)

10308 REGULARITIES IN THE ALLOY FORMATION OF RARE EARTH METALS. Terekhova, V. F. pp 133-136 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The character of the physical chemical interaction of rare earth metals with other elements of the periodic system is analyzed. The types of phase diagrams of rare earths and the effect of the 4f electrons on the formation of compounds in the rare earth system are discussed. (tr-auth)

10309 ELECTRODEPOSITION OF AN AMORPHOUS COBALT RHENIUM ALLOY. Cote, P. J.; Capsimalis, G. P.; Greco, V. P. (Watervliet Arsenal, NY). J. Electrochem. Soc.; 121: No. 6, 776-777(Jun 1974).

Formation of a Co–44at. % Re amorphous alloy by electrodeposition from a bath composed of aqueous $CoSo_4$, citric acid, NH_4 ReO_4 solution is reported. Information is included on current density vs cathode potential, crystal structure, and effects of annealing. (JRD)

10310 SURFACE-HARDENED TITANIUM OR ZIRCONIUM AND THEIR ALLOYS AND METHOD OF PROCESSING SAME. Ohtani, S.; Nishigaki, M. (to Kobe Steel, Ltd.). US Patent 3,802,939. 9 Apr 1974. Filed date 22 Mar 1971. 4p.

Surface-hardened pure titanium or pure zirconium, titanium-base alloys, or zirconium-base alloys having an applied coating of a metastable beta alloy layer of a titanium or zirconium-base metal are described. A method of hardening the surface of pure titanium, pure zirconium, titanium base alloys, or zirconium-base alloys, by coating using a metastable beta alloy of a titanium-base or zirconium-base metal and aging the coated alloy at temperatures of 200° to 600°C is described. (Official Gazette)

10311 ALLOYS. Brook, G. B.; Iles, R. F. (to Fulmer Research Institute Ltd.). US Patent 3,802,930. 9 Apr 1974. Priority date 1 May 1969, United Kingdom of Great Britain and Northern Ireland. 8p.

A method of making a heat-recoverable article from a heat-recoverable alloy is described such that after suitable treatment it changes its shape when appropriate temperature changes are made including the step of applying to the alloy in its high-temperature phase a strain which produces a stress inducing a desired shape for its low-temperature phase. The method may be used with new heat-recoverable alloys which are uranium binary alloys with molybdenum, niobium or rhenium or manganese–copper binary alloys. (Official Gazette)

10312 BRAZING JOINT RESISTANT TO SODIUM. Reetz, T.; Ullmann, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Kernenergie; 17: No. 2, 57-59(Feb 1974). (In German).

The development of a brazing material for metal/metal joints is described. The brazing material consists of a Ni-Ga paste forming a sodium-resistant alloy with the basic material at brazing temperatures between 1200 and 1400°C. Brazing joints between stainless steel and a Ni alloy were tested in sodium. The brazing area shows corrosion behavior similar to that of stainless steel. (auth)

10313 METHODS FOR EVALUATION OF QUALITY OF INDUSTRIAL POWDERS OF REDUCED TUNGSTEN AND MOLYBDENUM. Polyakov, B. I.; Ralevskii, P. Kh.; Kabakova, L. G.; Rumyantsev, V. K.; Kal'kov, A. A. pp 144-146 of Novye Metody Issledovaniya Protsessov Vosstanovleniya Tsvetnykh Metallov. Chizhikov, D. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From symposium on experimental methods for the study of ferrous and non-ferrous metals; Moscow, USSR (1 Nov 1971). See CONF-711158-.

Results of the use of new methods for the evaluation of the quality of industrial powders of reduced W and Mo were discussed. The methods consisted of the determination of the ratio of powder to oxidant and the determination of the total concentration of cation impurities of di- and tri-valent metals. (tr-auth)

10314 FABRICATION OF INDIVIDUAL LEAD BLOCKS FOR USE IN RADIOTHERAPY. Mello, N. M.; Vizeu, D. M. (Instituto de Radioterapia Osvaldo Cruz, Sao Paulo, Brazil). pp 221-229 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

In order to shield certain radiosensitive areas that are enclosed in the radiation field, lead blocks in standard shape and size are used. But as the patients are not standardized some errors are made irradiating areas that should be protected or shielding regions that should be irradiated. Besides the shape of the lead blocks another problem is the penumbra. The standard lead blocks have their faces parallels to the central axis of the radiation field causing the appearance of a penumbra zone. This fact is more troublesome in a ^{60}Co unit in which the source is not punctual. It's possible to reduce this penumbra making lead blocks with the faces parallels to the x-ray in any part of the field. There are presently several methods for the fabrication of individual lead blocks. Among them the more common are melting and machined. In the melting method it is necessary to make a model with which one makes a mould in sand that is filled with melting lead. After cooling we have a piece of lead identical to the model. In the machined blocks, standard lead blocks with adequate thickness are used, and cut according to a model, in this process the faces are parallels so we still have the penumbra. There is also a considerable waste of material, and in order to reuse it we must have a melting facility. (auth)

10315 DEPOSITION OF METALLIC TUNGSTEN. Robert, J. F. (CNRS, Montlouis, France). Rev. Int. Hautes Temp. Refract.; 10: No. 4, 251-254(Oct 1973). (In French).

From meeting on solar furnaces and image furnaces; Odeillo-Font-Romeu, France (1 Oct 1971).

In recent years, the deposition of tungsten from the gas phase has superseded classical powder metallurgy methods. The reduction of WF_6 with hydrogen is a very convenient method owing to the ease with which WF_6 can be handled (boiling point of 19.5°C) and the relatively low temperatures at which good vapor deposition can be obtained (600 to 1100°C). Results and experimental conditions are given. The direct decomposition of WF_6 is investigated from the thermodynamic point of view. (FR)

10316 THERMOCHEMICAL HIERARCHY OF TRANSITION METAL CARBIDES. Application to the Preparation of Rare Earth Metals. Male, G.; Trombe, F. (CNRS, Montlouis, France). Rev. Int. Hautes Temp. Refract.; 10: No. 4, 255-260 (Oct 1973). (In French).

From meeting on solar furnaces and image furnaces; Odeillo-Font-Romeu, France (1 Oct 1971).

The thermochemical hierarchy of carbides was exploited in order to displace rare earth metals from their carbides with metallic

tantalum. The preparation of dysprosium, lanthanum, gadolinium, and yttrium from their carbides is described. (FR)

Properties, Structure, and Phase Studies

Refer also to abstracts 9098, 9127, 10250, 11510, 11530, 11848, 12007, and 12159.

10317 (CONF-7209109-, pp 1-19) SOME FACTORS AFFECTING HIGH-TEMPERATURE STRENGTH OF MATRIX IN HEAT RESISTING ALLOYS. Suto, H. (Tohoku Univ., Sendai). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

Dominant factors affecting the solid solution hardening in low alloy steels and superalloys are examined. Results are presented showing that interstitial and substitutional atoms affect the creep strength of these steels. The creep strength of superalloys is strongly affected by the diffusion constant, Youngs modulus, stacking fault energy and dragging stress. (JRD)

10318 (CONF-7209109-, pp 11-22) MECHANISMS OF GROWTH OF γ' PARTICLES AND TENSILE YIELD IN UDIMET 520. Doi, H.; Shimanuki, Y. (Mitsubishi Metal Corp., Omiya, Japan). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

Although a number of theoretical analysis results have been reported on precipitation hardening of simple binary or ternary Ni-base alloys which involve γ' precipitates, quantitative studies of the precipitation hardening of commercial superalloys have been comparatively scarce. Variations of size, volume fraction, and lattice parameter of γ' particles in a commercial superalloy, Udimet 520, with aging time and the resulting variation of the room-temperature proof stress are analyzed. A comparison of the predicted strength values, derived on the basis of the theoretical model of shearing of γ' particles by paired dislocations, with the measured values was carried out. (auth)

10319 (CONF-7209109-, pp 23-33) MICROSTRUCTURE AND PLASTIC DEFORMATION OF THE Ni_4Mo ALLOY. Saburi, T.; Fujii, H.; Nenno, S. (Osaka Univ.). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

The plastic deformation behavior of Ni-20 at.% Mo in ordered and disordered states was studied. An analysis of deformation in the ordered stage reveals that twinning is energetically favored over slip in this stage. An explanation of the change in plastic deformation mode caused by ordering is included. (JRD)

10320 (CONF-7209109-, pp 34-47) MICROSTRUCTURE OF AUSTENITIC HEAT-RESISTING STEELS WITH HIGH NITROGEN CONTENT. Tanaka, R.; Kikuchi, M.; Wakita, S. (Tokyo Inst. of Tech.). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

Results of an investigation are presented in which the effects of N on the creep-rupture strength of steels are correlated with microstructure. Data and discussion are included on x-ray diffraction, lattice parameters, and mechanical properties. (JRD)

10321 (CONF-7209109-, pp 48-62) CHARACTERIZATION OF AGE-HARDENABILITY AND STRESS-RUPTURE PROPERTIES OF SOME COBALT-BASE ALLOYS. Yukawa, N. (Nagoya Univ., Japan). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

A physico-metallurgical study was made on 24 kinds of wrought alloy in Co-base-Cr-Ni systems containing varying quantities of C, Mo, W, and Nb. As a result, it was found that four kinds of carbide phases and four kinds of intermetallic compounds were formed in these alloys. Also, the alloys were classified into four types on the basis of age-hardening characteristics, each of which showed peculiar pattern of precipitation behavior. The results also showed that medium- and high-C alloys containing W had strong rupture strength, and it was confirmed that the consecutive precipitation through carbide reactions at high temperature is important. (auth)

10322 (CONF-7209109-, pp 63-72) CHARACTERISTICS OF SECONDARY PHASES IN HEAT-RESISTING ALLOYS. Masumoto, T. (Tohoku Univ., Sendai). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

Methods used in structural analysis of heat-resisting alloys are described. A discussion is included on correlation between the mechanical properties of alloys and the characteristics of their secondary phases. It is pointed out that potentiostatic isolation is a useful technique in quantitative analysis of microstructure. Transition precipitates occurring during aging contributes to age hardening. (JRD)

10323 (CONF-7209109-, pp 73-83) STRENGTH AND MICROSTRUCTURE OF NICKEL-BASE SUPERALLOYS AFTER LONG TERM HEATING. Susukida, H.; Sakumoto, Y.; Tsuji, I.; Kawai, H. (Mitsubishi Heavy Industries, Ltd., Akashi, Japan). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

The qualitative stability of advanced Ni-base superalloys such as Udimet 520, Udimet 710, MAR-M421 and IN-738X were tested by subjecting them to long term heating at higher temperature. A series of experiments was continued for up to 10,000 h to show the changes in the mechanical properties and the thermal fatigue properties and their correlation with change in the microstructure. Information is included on testing procedures and results. Tabulated results are included on alloy composition, x-ray diffraction, stress rupture properties, Charpy tests, and thermal fatigue. (JRD)

10324 (CONF-7209109-, pp 97-105) EFFECT OF ALLOYING ELEMENTS ON CREEP RUPTURE STRENGTH AND MICROSTRUCTURE OF 12 PERCENT CHROMIUM HEAT RESISTING STEEL. Fujita, T. (Tokyo Univ.). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

The effects of molybdenum, tungsten, vanadium, niobium, carbon, boron, and nitrogen on the creep rupture strength of 12% chromium heat resisting steel has been investigated. It was found that 1.2 to 1.5% molybdenum, 0.2% vanadium, 0.20% niobium, 0.04% boron, and 0.020% nitrogen are the best composition. (auth)

10325 (CONF-7209109-, pp 106-118) EFFECTS OF HEAT TREATMENT ON THE MECHANICAL PROPERTIES AND MICROSTRUCTURE OF INCONEL ALLOY 718. Nishi, Y.; Matsunaga, K. (Japan Special Steel Co., Ltd., Tokyo). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

The effects of heat treatment on the mechanical properties and microstructure of Inconel Alloy 718 were investigated. On samples solution treated at 954°C for 1 h, aged at 719 to 621°C for 8 h, the effects of furnace cooling rate from 719 to 621°C on the room temperature tensile and high temperature stress rupture properties were studied. Tensile strength and stress rupture life increased and ductility decreased, as the cooling rate decreased. Higher solution temperature decreased room temperature tensile strength and increased tensile ductility, but increased stress rupture life and decreased rupture ductility. Secondary aging at 649°C resulted in higher tensile strength and rupture life and lower tensile and rupture ductility than at 621°C. (auth)

10326 (CONF-7209109-, pp 119-167) HIGH TEMPERATURE STRENGTH AND MICROSTRUCTURE OF NICKEL-BASE HEAT RESISTING NO. 64BC ALLOY. Yoda, R.; Watanabe, T.; Sato, Y. (National Research Inst. for Metals, Tokyo). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

Modification of Nimonic 100 alloy to effect good high-temperature strength and casting properties is reported. Additions of 5 to 6% Al and 3 to 4% Ti improved the high temperature strength of the alloy and the optimum composition contained these additions plus 0.06 to 0.42% B and 0.01 to 0.55% C. (JRD)

10327 (CONF-7209109-, pp 211-213) THORIA DISPERSION STRENGTHENED NICKEL BASE ALLOYS. Wilcox, B. A. (Battelle Columbus Labs., Ohio). 1972.

From Japan-U. S. seminar on the physical metallurgy of heat resisting alloys; Diamond Point, New York, USA (13 Sep 1972).

Strengthening mechanisms in TD-Nickel and TD-Nickel Chromium are examined. It is shown that substructural strengthening is more effective at 25°C than dispersion hardening. Discussions are included on powder preparation, uses of the cermet alloys, fabrication, and oxidation. (JRD)

10328 (COO-3166-8) HYDROGEN GAS EMBRITTLEMENT. Report No. 2121. Johnson, H. H. (Cornell Univ., Ithaca, N. Y. (USA)). Nov 1973. 18p. (CONF-730992-2). Dep. NTIS $4.00.

From conference on hydrogen in metals; Pittsburgh, Pennsylvania, USA (23 Sep 1973).

The basic characteristics of the brittleness induced in many alloys by hydrogen gas are reviewed, discussed, and contrasted with the characteristics of classical hydrogen brittleness. The diffusion penetration distance of hydrogen ahead of a moving crack is estimated. The influence of elastic stresses and plastic deformation upon hydrogen distribution is qualitatively assessed. (auth)

10329 (KFK-EXT-6-73-6) LITERATURE RESEARCH ON SOME PROPERTIES OF ZIRCALOY-4 AT HIGHER TEMPERATURES. Petersen, C. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Mar 1974. 42p. (In German). Dep. NTIS (US Sales Only) $5.25.

Results of a literature research are presented in which mechanical and physical properties of Zircaloy-4 are compiled for the temperature interval of 600 to 1800°C. The behavior of stress–strain, ultimate strength, and ductility under internal pressure, thermal expansion, thermal conductivity, and total emissivity are described. (auth)

10330 (ORNL-tr-2817) DIFFUSION CREEP. Oikawa, H.; Karashima, S. Translated by H. Kubota from Nippon Kinzoku Gakkai Kaiho; 11: No. 8, 567-576(1972). 33p. Dep. NTIS $4.75.

There are two important high-temperature deformation mechanisms of polycrystals under stress so low that the deformation is not due to intragrain dislocation slip: (i) diffusion-controlled boundary slip (or diffusion creep in the wide sense) and (ii) boundary slip due to dislocation that also incorporates superplasticity. Of these two mechanisms, an analysis that takes into account the continuity of polycrystals will encounter problems in the form of the shape of the crystal, size, and deployment in the case of diffusion-controlled creep. The presence of small ledges or precipitates along the boundary along with some movement of the boundary itself do not exert too pronounced an effect. Consequently, the experimental results obtained with boundary slip (wide sense) of twin crystals or the experimental results obtained with diffusion creep (narrow sense) in foils or thin wires are important for the analysis of the basic process; however, some further consideration may be in order before these results can be directly tied in with creep behavior at low stress of polycrystals. (16 fig, 75 references) (auth)

10331 (ORNL-tr-2819) STEADY STATE CREEP CHARACTERISTICS OF Fe–3.5 at. % Mo ALLOY AT HIGH TEMPERATURES. Oikawa, H.; Karashima, S.; Maeda, M. Translated by H. Kubota from J. Jap. Inst. Metals; 37: No. 6, 599-603(1973). 12p. Dep. NTIS $4.00.

The deformation structure, internal stress, and relaxation behavior of Fe–3.5 at. % Mo alloy in the steady-state creep process at 850°C were investigated, and the following results were obtained: (1) No outstanding differences in the creep structure were seen compared to that seen in α-Fe. (2) The internal stress was at a very low level and was of a nearly constant value independent of of the external stress. (3) The effective stress index of the steady-state creep rate was about 2.7 while the effective stress index of the subgrain dislocation density was about 1.5. As a result, the effective stress index for the dislocation translation rate is thought to be of the order of 1. (4) The relationship $\sigma^* \propto \exp(-t)$ is valid between effective stress σ^* and time t in stress relaxation experiments directly after creep. In other words, this indicates that the stress relaxation behavior has the dislocation rate proportional to σ^*. (5) It may be said that the creep deformation of Fe–3.5 at. % Mo alloy at 850°C and stress of 1.1 to 4.0 kg/mm^2 is controlled by an essentially model microcreep mechanism as the rate-determining process. (auth)

10332 (RISO-M-1701) EXCHANGE INTERACTION IN THE HEAVY RARE EARTH METALS CALCULATED FROM ENERGY BANDS. Lindgard, P. A. (Danish Atomic Energy Commission, Risoe. Research Establishment). Feb 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

The indirect exchange interaction (RKKY) is calculated for the heavy rare earth metals. The conduction electrons are treated by the argumented-plane-wave (APW) method. Numerical results for the susceptibility χ_q for APW and free electrons are given. The numerical accuracy is tested for the free electron model using both a root-sampling method and a linearized integral method. The first method requires 450,000 and the latter 9,000 points in the entire Brillouin zone for a good agreement with the Lindhard function. χ_q and the wave vector dependent exchange integral J_q is calculated for Gd, Tb, Dy, and Er in the ordered phase. J_q is calculated for Gd with the inclusion of the matrix element, calculated on the basis of APW functions. (auth)

10333 MECHANISM OF HEAT CONDUCTION IN POROUS METALLIC MATERIALS. Anishchenko, L. M.; Brekhovskikh, V. F. (Inst. of Metallurgy, Moscow). Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 53-56(Apr 1974). (In Russian).

Experimental and estimated data are presented on heat and electric conduction of high-porous molybdenum within a temperature range of 300 to 1300°K. The mechanism of conduction and Lorentz function were investigated for molybdenum with porosity above 60%. The effect of porosity on the value of the heat conduction coefficient components is also studied. (auth)

10334 THERMAL EXPANSION OF REINFORCED MATERIALS ALUMINUM–STEEL AND TITANIUM–MOLYBDENUM. Karpinos, D. M.; Kadyrov, V. Kh.; Klimenko, V. S.; Fefer, V. Ya.; Miroshnikova, T. K. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 57-60(Apr 1974). (In Russian).

Temperature and concentration dependences of the thermal expansion coefficient were studied in Al- and Ti-base composite materials. The materials were reinforced with unidirectional high-tenacity steel and molybdenum fibers within a temperature range of 200–1000°K. The thermal expansion coefficient value was studied as affected by the material composition and type of fiber arrangement in the matrix. (auth)

10335 HIGH-TEMPERATURE RESEARCHES IN POROUS TUNGSTEN THERMAL PROPERTIES. Logunov, A. V.; Chevela, O. B.; Silaev, A. F. Porosh. Met., Akad. Nauk Ukr. SSR; No. 4, 61-67(Apr 1974). (In Russian).

Temperature dependence was studied for the coefficient of heat conduction, resistivity, and degree of blackening in porous tungsten after high-temperature annealing. The temperature dependences of the heat conduction coefficient and resistivity are presented for both liquefied and pulverized tungsten. (auth)

10336 LOW TEMPERATURE HEAT CAPACITY OF SOME RARE EARTH LAVES PHASES. Gschneidner, K. A. Jr.; Joseph, R. R.; Hugsberg, R. E.; Koskimaki, D. C. pp 32-33 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The low-temperature heat capacities of Al Laves phases in with Y, La, and Lu were measured along with those in compounds of Pt with La and Ce and those in Pt–Ru compounds with La, Ce, and O. Data on the electrical Properties of these compounds are discussed along with data on the Debye temperature of the Laves Phases. (JRD)

10337 MAGNETIC AND ELECTRICAL CHARACTERISTICS OF TERNARY SYSTEMS INVOLVING RARE EARTHS AND D-TRANSITION METALS. Wallace, W. E.; Craig, R. S.; Rao, V. U. S.; Butera, R. A. pp 37-46 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izadetel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

Results of studies on ternary transition metal systems containing rare earths (Re) are presented. Information and discussions are included on observed magnetic properties of systems containing Al, Re–Re coupling systematics effects of alloying on magnetic anisotropy, effects of alloying on intersublattice coupling, and miscellaneous effects. (JRD)

10338 HALL EFFECT IN RARE EARTH METALS IN THE ANTIFERROMAGNETIC REGION. Abel'skii, Sh. Sh; Raevskaya, L. T. pp 47-49 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The spontaneous Hall coefficient for the high temperature regions was calculated with a consideration of the gaps and the elastic and inelastic terms in the scattering. One of the causes of the difference of the Hall effect in ferro-and antiferromagnetic metals is the strong temperature dependence of the common Hall coefficient in the antiferromagnetic metals. (tr-auth)

10339 FIELD INDUCED TRANSITIONS IN RARE EARTH INTERMETALLIC COMPOUNDS. Taylor, K. N.; Hunter, J.; Poldy, C. A. pp 50-58 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

Results of measurements are presented on rare earth. Intermetallic phases in which complex magnetic structures occur in ordered lattices as result of low ordering temperatures and high anisotropies. Some of these materials are antiferromagnetic and others are ferromagnetic, the observed behavior arising as a result of exchange and crystal field interaction energies. (JRD)

10340 MAGNETIC AND STRUCTURAL PROPERTIES OF PSEUDOBINARY COMPOUNDS IN THE Y–Fe–Co AND Y–Co–Ni PHASE DIAGRAMS. Taylor, K. N. R.; Poldy, C. A. pp 59-70 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-710978–.

Results of studies of ordered moments and transition temperatures in these compounds are presented. Discussions and data are included on solid solubilities and the composition dependencies of crystal lattice parameters. (JRD)

10341 METALLURGICAL AND MAGNETIC PROPERTIES OF THE INTERMETALLIC PHASES $R_2(Co, Fe)_{17}$. Ray, A. E.; Strnat,

K. J. pp 75-85 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

Results of studies on these intermetallics are summarized. Data and information are included on lattice parameters, melting behavior, Curie temperature, magnetic symmetry, magnetization, and potential energy of magnetic phases. (JRD)

10342 GROWTH OF MONOCRYSTALS OF ALLOYS OF DYSPROSIUM WITH GADOLINIUM AND YTTRIUM AND THEIR PROPERTIES. Belov, K. P.; Dmitrievskii, A. S.; Levitin, R. Z.; Popov, Yu. F.; Savitskii, E. M.; Terekhova, V. F.; Chistyakov, O. D. pp 86-88 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

Monocrystals of alloys of Dy with Gd and Y were grown by the method of vertical crucibleless zone fusion with induction heating in He atmosphere. The magnetization intensity was measured in monocrystals along different crystalline planes in a pulsed magnetic field up to 280 kOe. From the data obtained the coefficient of uniaxial magnetic anisotropy K_2^0 was determined in the the temperature interval from 4.2°K to the Curie point. It was shown that the anisotropy constant depends linearly on the Dy concentration. It was concluded that the magnetic anisotropy of Dy and its alloys is basically monoionic. Data on the monoionic character of the anisotropy confirms also the measurement of the paramagnetic susceptibility of the alloys. The magnetostriction of the alloys was measured and the anisotropy constant in the basal plane was determined from these measurements. (tr-auth)

10343 MAGNETIC AND MAGNETOSTRICTION PROPERTIES OF INTERMETALLIC COMPOUNDS OF RARE EARTH METALS WITH IRON OF THE TYPE RFe_2 AND RFe_3. Belov, K. P.; Nikitin, S. A.; Savitskii, E. M. pp 89-91 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

The magnetic properties of intermetallic compounds of the rare earths with Fe of the type RFe_2 and RFe_3 were studied where R is Gd, Tb, Dy, Ho, Er, Tm, and Lu. The temperature dependence of the spontaneous magnetization intensity, the coercive force, remanent magnetization, Curie point, and the absolute saturation magnetization were determined. The magnetic behavior of these alloys indicates the ferromagnetic character for compounds of the rare earth metals. The anomalies in the hysteresis and other properties at the temperature of magnetic compensation were discussed. The characteristics of the magnetism of these compounds can be explained on the basis of the exchange interaction of the sublattice of the Fe ions and the sublattice of the rare earth ions under the assumption of antiparallel orientation of the magnetic moments of these sublattices. (tr-auth)

10344 MAGNETIZATION PROCESS IN FERROMAGNETIC RARE EARTH INTERMETALLIC COMPOUNDS WITH STRONG ANISOTROPY. Barbara, B.; Lemaire, R. pp 92-97 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

Results of studies on the magnetic properties of spherical monocrystals of Dy_3Al_2 are presented. It was found that magnetization depends on the applied field strength and the duration of field application. Domain reversal was found to be time dependent in weaker coercive force fields. (JRD)

10345 DOMAIN AND CRYSTAL STRUCTURE OF ALLOYS OF COBALT WITH THE RARE EARTH METALS. Vetoshkin, I. D.; Gorbunov, V. I.; Grunau, L. M.; Potapov, N. N.; Skokov, A. D.; Kozlov, A. G. pp 98-101 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

The domain and crystal structure of binary alloys of Co with the rare earth metals Ce and Sm were studied by metallographic, powder, and x-ray methods in the composition range from 10 to 20 at. % of the Ce and Sm. The concentration dependence of the lattice constants with the $CaZn_5$ structure was constructed. It was shown that compounds with this structure are disordered near the composition RCo_5. At temperatures below 1250°C two isostructural compounds with similar lattices were observed. The domain structure of these compounds are different according to the intensity of precipitation of powders from magnetic suspensions. In the cast alloys there were two structural regions with sharp boundaries near the composition RCo_5. (tr-auth)

10346 MAGNETIC PROPERTIES OF ALLOYS OF COBALT WITH THE RARE EARTH METALS. Ckokov, A. D.; Krasavin, Ku. I.; Potapov, N. N.; Kozlov, A. G.; Vetoshkin, I. D.; Eidinov, A. Ya. pp 102-103 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

The dependence of the saturation magnetization, the effective magnetic anisotropy constants, coercive force, and energy product on the chemical composition of the alloys of the Co–Ce and Co–Sm systems was studied at rare earth concentrations from 10 to 20 at. % (R_2Co_{17} to R_2Co_7). (tr-auth)

10347 MAGNETOCRYSTALLINE ANISTROPY OF $CeCo_5$ MONOCRYSTALS. Skokov, A. D.; Eiinov, A. Ya.; Potapov, N. N.; Vetoshkin, I. D.; Sadchikov, V. V.; Krasavin, Y. I. pp 104-106 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

The constant of magnetic crystalline anisotropy was studied by several methods on monocrystals of $CeCo_{5-5}$. Satisfactory agreement between the values for K_1 was obtained principally by different extrapolation methods to the magnetization curve and to the torque curve. The K_1 values obtained (3.5, 3.3, and 3.8) × 10^7 erg/cm^3 agree well with the literature data on $CeCo_5$ monocrystals. Possible causes for the divergence of the K_1 values measured on monocrystalline samples and on quasimonocrystalline powder samples of the same alloy are discussed. (tr-auth)

10348 CURIE POINT OF IRON–NICKEL ALLOYS WITH ADDITIONS OF RARE EARTH METALS. Kirshenina, I. I.; Fedotov, L. N. pp 107-108 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

The Curie point of Invar Fe–Ni alloys with additions of 0.1 at. % Eu, Gd, and Dy was measured. The results were compared with data from the dilatometric measurements, data on the changes in the magnetization intensity, and electrical resistivity with pressure. (tr-auth)

10349 THEORY OF THE COERCIVE FORCE OF ALLOYS OF THE RARE EARTH METALS WITH COBALT. Mishin, D. D.; Grechishkin, R. M. pp 109-115 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

The effect of dislocations on the processes of magnetic reversal of highly coercive materials was theoretically studied. Calculations were made of the interaction of the domain boundaries with the dislocations. The dislocation theory made it possible to explain the large size of the coercive force experimentally observed in particles of alloys of the rare earths with Co. (tr-auth)

10350 PERMANENT MAGNETS FROM COBALT- AND RARE EARTH METAL-BASED ALLOYS. Grechishkin, R. M.; Leonovich, I. G.; Mishin, D. D.; Tsirkov, A. I. pp 116-120 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

Processes for the production of permanent magnets from alloys of the rare earth metals with Co were investigated. It was established that the most promising method is powder sintering. For production of large-scale products it is advisable to use cast anisotropic and isotropic magnets of these alloys. (tr-auth)

10351 MAGNETIC PROPERTIES OF INTERMETALLIC COMPOUNDS OF RARE METALS OF THE TYPE RX_3 (X = TIN, LEAD). Stalinskii, B.; Chopnik, A.; Mydlyazh, T. pp 121-122 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978--.

The magnetic susceptibility of $EuSn_3$, $EuPb_3$, $GdSn_3$, $GdPb_3$, $YbSn_3$, and $YbPb_3$ was measured by the Faraday method in the temperature range from 1.5 to 300°K in magnetic fields up to 6.5 kOe. The magnetization intensity was measured by the induction method in stationary magnetic fields up to 80 kOe in the temperature range from 4.2 to 100°K. (tr-auth)

10352 MICROSTRUCTURE OF SAMARIUM–COBALT ALLOYS IN THE CAST STATE. Nam, B. P.; Klin, V. P.; Ivanov, V. I.;

Busol, F. I.; Bykovskaya, L. S.; Mikheev, N. N. pp 123-124 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The microstructure of alloys of Co with 27 to 42 wt. % Sm was studied with the purpose of detecting the optimum structure guaranteeing a high magnetic energy for the material. The relation between the alloy structure and its magnetic properties was established. (tr-auth)

10353 MAGNETOELASTIC INTERACTIONS IN RARE EARTH. Bartholin, H. pp 125-129 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

Quantitative values of magnetoelastic coupling constants and magnetostriction coefficients at 0°K for Gd, Tb, and Dy are given. The analysis of the results shows that the value of the variation with the interatomic distances of the second order anisotropic coefficient ∇^2_{zz} at 0°K is not very different from the value obtained by extrapolation of paramagnetic measurements. (auth)

10354 VOLATILITY OF THE INTERMETALLIC COMPOUND $SmCo_5$. Fedichkin, G. M.; Shmaykov, A. A.; Ignatov, D. V.; Lazarev, E. M. pp 130-132 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

Experimental data are reported on the determination of the temperature dependence of the equilibrium vapor pressure over $SmCo_5$ in the homogeneous region. The type of dissociation reaction of this compound within this region was established. The experiments were made in a high-vacuum installation in which a differential variant of the Knudsen effusion method was used with simultaneous weighing of the target with condensates on a sensitive quartz torsion balance. (tr-auth)

10355 LAVES PHASE FAMILIES CONTAINING LANTHANIDES AND OTHER METALS. Schulze, G. E. R.; Leitner, G.; Paufler, P. pp 137-142 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

Results are presented on studies of Laves phases in binary rare earth alloy systems represented by Rx_2 in which the rare earth component (R) remains fixed and RB_2 phases in which the B component remains fixed. Discussions are presented to show that in some cases it is possible to understand rare earth Laves phases with other metals, however, this is true only on the basis of structural hypotheses such as those involved in radius ratio, highest density principle, or phenomenological thermodynamics. (JRD)

10356 TERNARY SYSTEMS OF RARE EARTH METALS WITH SILICON, GERMANIUM, AND D-ELEMENTS. Bodak, O. I.; Gladyshevskii, E. I. pp 143-145 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

As a result of the study of ternary systems of the rare earths about 700 metalloids containing rare earths were detected and the crystalline structure was determined for 625 of them. The systems R-M-{Si, Ge}, where M represents the transition metals, were the most completely studied. The existence of 300 compounds was established and the crystalline structure was determined for 205 ternary silicides and 69 ternary germanides. An increase of the concentration of Si in the compounds with simultaneous increase of the rare earth concentration leads to a decrease of the coordination number of the Si atoms from 12 to 6. The valence state of the atoms is also altered. (tr-auth)

10357 PHASE DIAGRAM OF THE TERNARY SYSTEM OF RARE EARTH METALS AND ALUMINUM WITH DIFFERENT COMPONENTS. Zarechnyuk, O. S.; Rykhal, R. M.; Murav'eva, A. A.; Ryabokon, T. I. pp 148-149 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

Forty-eight ternary systems of the rare earths and Al with different components were examined. It was established that in systems with d transition metals the maximum number of ternary compounds appear in the case of Ni and Cu and in systems with elements of the P subgroup in the case of Ge and P. The characteristics of the type of crystalline structure were established. (tr-auth)

10358 STRUCTURAL AND THERMODYNAMIC PROPERTIES OF THE Sc-H SYSTEM. Lundin, C. E. pp 159-163 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973).

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

Results of studies on the lower temperature regions of the Sc-H phase diagram are presented. The studies were conducted using Sievert's analysis, metallography, and x-ray diffraction. Data and discussions are included on solid solubility, boundary Sc-H composition, and saturated H phases in the Sc-H system. (JRD)

10359 PHYSICAL-CHEMICAL STUDY OF YTTRIUM ALLOYS. Markova, I. A.; Terekova, V. F.; Savitskii, E. M. pp 164-165 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

Experimental data on alloys of Y and on the regularities of its physical-chemical interactions with other elements of the periodic system were generalized. Future areas for the use of Y and its alloys and compounds were indicated. (tr-auth)

10360 SAMARIUM ALLOYS AND THEIR POSSIBLE USES. Torchinova, R. S.; Terekhova, V. F.; Savitskii, E. M. pp 166-168 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

Data from a study of the phase diagrams of Sm-Cu, Sm-Co-Cu, Sm-Co-Ni, and Sm-Co-Fe are reported. The polythermal cross sections $SmCo_5$-$SmCu_5$, $SmCo_5$-$SmNi_5$, and Sm_2Co_{17}-Sm_2Fe_{17} are constructed. Possible uses of these systems in permanent magnets are discussed. (tr-auth)

10361 ERBIUM-TELLURIUM SYSTEM. Abrikosov, N. Kh.; Poretskaya, L. V.; Skudnova, E. V. pp 174-175 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The phase diagram of the Er-Te system was constructed for every concentration interval. The formation of three chemical compounds in the system was established. The thermoelectric properties of the alloy were measured. (tr-auth)

10362 PRASEODYMIUM-GERMANIUM SYSTEM. Rustamov, P. G.; Nassibov, I. O.; Alieva, M. M. pp 176-177 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The phase diagram of the Pr-Ge system was constructed in all concentration intervals. Four chemical compounds were found. Two of these compounds are polymorphic. (tr-auth)

10363 CHARACTERISTICS OF THE INTERACTION OF PALLADIUM WITH THE RARE EARTH METALS. Savitskii, E. M.; Polyakova, V. P.; Tsyganova, I. A.; Roshan, N. R. pp 178-181 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

An analysis was given of the interaction of Pd with Sc, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, and Lu. The characteristics of these interactions and of the formation of solid solutions and chemical compounds are examined. (tr-auth)

10364 PHASE DIAGRAM OF OSMIUM-YTTRIUM. Savitskii, E. M.; Polyakova, V. P.; Tsganova, I. A. pp 182-184 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978-.

The phase diagram of Os-Y was constructed by physical-chemical analysis. The existence of the Laves phase YOs of the $MgZn_2$ type was confirmed and a new compound Y_3Os was detected. The small mutual solubility of the components in each other was established. Curves of the changes of the alloy properties with the composition confirmed the position of the phase regions in the system. (tr-auth)

10365 PHASE DIAGRAMS AND PROPERTIES OF ALLOYS OF THE IRIDIUM-CERIUM SYSTEM. Dmitrieva, V. N.; Rezukhina, T. N.; Varekha, L. M. pp 185-186 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The phase diagram of the Ir–Ce system was constructed. The formation of eight compounds was established. The thermodynamic properties of some phases were determined. (tr-auth)

10366 EFFECT OF MICROADDITION OF CERIUM AND YTTRIUM ON SOME PROPERTIES OF ZIRCONIUM ALLOYS. Ivanov, O. S.; Taraeva, E. M.; Murav'eva, L. S. pp 187-189 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The alloying of oxygen-containing alloys of Zr with 1 and 2.5 at. % Nb and of the same alloys without oxygen with Ce and Y in quantities of 0.001 and 0.01 at. % was reported. The effect of Ce and Y on the corrosion stability in water at 300 and steam at 400°C and the mechanical properties at room temperature and 400°C was studied. The alloying leads to an increase of the strength tensile characteristics and increases the corrosion stability in steam at 400°C for the alloys with no oxygen. The alloying of the alloys containing oxygen is less effective. (tr-auth)

10367 PHASE COMPOSITION AND MAGNETIC PROPERTIES OF FILMS OF COMPOUNDS OF THE RARE EARTH METALS WITH METALS OF THE IRON GROUP. Buravikhin, V. A.; Bochkarev, V. F.; Egorov, V. A.; Shelkovnikov, V. N. pp 254-256 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The phase composition and magnetic properties of films of binary compounds of Sm, Gd, Dy with Fe, Co, and Ni are described. (tr-auth)

10368 ELECTRON STRUCTURE, STRUCTURE, AND PHYSICAL PROPERTIES OF LANTHANIDES. Samsonov, G. V.; Gordienko, S. P. pp 257-260 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

A configuration model of matter was proposed for application to lanthanides. The model made it possible to examine various physical and chemical properties on the basis of the characteristics of the electron structure. (tr-auth)

10369 MICROSTRUCTURE OF ALLOYS OF TUNGSTEN WITH OXIDES OF THE RARE EARTH METALS. Morokov, V. I.; Faifer, S. I.; Savranskaya, E. S.; Shiryaeva, D. I.; Zhdanov, S. M. pp 300-302 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The effect of the chemical history and the thermal processing on the microstructure of alloys of W with oxides of Y, Sm, Tb, and Dy was studied. It was established that with respect to homogeneity the structures of composition materials of W–rare earth oxides are affected substantially by the original reagents and the thermal processing regime. (tr-auth)

10370 EFFECT OF YTTRIUM ON THE SUPERCONDUCTING PROPERTIES OF NIOBIUM–ZIRCONIUM AND NIOBIUM–TITANIUM ALLOYS. Savitskii, E. M.; Baron, V. V.; Frolov, V. A. pp 308-309 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The effect of additions of up to 2% Y on the superconducting properties of Nb–33Zr, Nb–50Zr, and Nb–63Ti was studied. It was established that the introduction of Y leads to an increase of the critical current density and improves the deformability of the alloys in the cold state. (tr-auth)

10371 SUPERCONDUCTING PROPERTIES AND STRUCTURE OF SOME BINARY SYSTEMS OF RARE EARTH METALS WITH TRANSITION METALS OF THE IV AND V GROUPS AND LEAD. Savitskii, E. M.; Efimov, Yu. V. pp 310-316 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

The phase diagrams and composition-T_K diagrams of binary systems of rare earths with transition metals and Pb were studied on vapor-deposited films. V–Sc, V–Y, V–Pr, V–Nd, V–Ho, V–La, V–Ce, V–Sm, V–Gd, V–Er, Nb–Sc, Nb–La, Nb–Ce, Nb–Sm, Pb–La, and Pb–Sm systems were prepared. The relation of T_K with the type of phase diagram was discussed. (tr-auth)

10372 STANDARD NEUTRON-ACTIVATION DETECTORS FROM ALLOYS OF THE RARE EARTH METALS FOR USE IN NUCLEAR REACTORS. Savitskii, E. M.; Terekhova, V. F.; Markova, I. A.; Vasil'ev, R. D.; Gnusin, Yu. K.; Grigor'ev, E. I.; Yaryna, V. P. pp 335-336 of Redkozemel'nye Metally Splavy i Soedineniya. Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian)

From 7th conference on rare-earth metals alloys and compounds; Moscow, USSR (12 Sep 1972). See CONF-720978–.

Neutron-activation detectors were made of alloys of Dy, Lu, Er, Sm, or La with Al. The characteristics of these standard detectors were summarized. (JSR)

10373 TERNARY SYSTEM Sm–Fe–Al IN THE RANGE 0 TO 33.3 AT. % Sm. Vivchar, O. I.; Zarechnyuk, O. S.; Ryabov, V. R. (Lvov Maintained Univ., USSR). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 4, 363-365(Apr 1974). (In Ukrainian).

The ternary system Sm–Fe–Al was studied by means of x-ray and microscopic analyses in the range of 33.3 at. % Sm. The isothermal section (500°C) of the studied range has been constructed. In this region there are three ternary compounds: $SmFe_2Al_{10}$ (ψ'-phase, unknown structure), $SmFe_{3.9-5.6}Al_{8.1-6.4}$ (ψ-phase, $ThMn_{12}$ type), $SmFe_{1.1-1.4}Al_{3.9-3.6}$ (λ_1-phase, $MgZn_2$ type), and three solid solutions based on the binary compounds: $Sm_2Fe_{17.0-18.5}Al_{0-6.5}$ (φ_2-phase, Th_2Zn_{17} type), $SmFe_{2.0-1.5}Al_{0-0.2}$, and $SmAl_{2.0-1.7}Fe_{0-0.3}$ ($\lambda_{2(Fe)}$- and $\lambda_{2(Al)}$-phases, $MgCu_2$ type). (auth)

10374 E. M. F. STUDY OF THE THERMODYNAMIC PROPERTIES OF THE COMPOUNDS OF GADOLINIUM AND ERBIUM WITH INDIUM. Bayanov, A. P.; Afanas'ev, Yu. A.; Pogorelaya, N. M. Kuban State Univ., Krasnodar, USSR). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 8, 1186-1187(Aug 1973).

Translated from Zh. Fiz. Khim.; 7: No. 8, 2105-2106(Aug 1973).

E.M.F. of concentration cells between gadolinium or erbium and their indium alloys (4.5 to 10.2 wt. % Gd and 6.4 to 9.2 wt. % Er) was in the temperature range 400 to 600°C. From the results, expressed as $E = f(T)$, the basic thermodynamic formation functions were calculated for $GdIn_3$ and $ErIn_3$ from the solid rare-earth metals and liquid indium at the temperature of the experiment. (auth)

10375 LOW-TEMPERATURE THERMAL CONDUCTIVITY OF NIOBIUM–ZIRCONIUM ALLOYS. Morton, N.; James, B. W.; Wostenholm, G. H.; Nicholls, R. J. (Salford Univ., Eng.). J. Phys., F (London); 4: No. 4, L94-L97(Apr 1974).

The thermal conductivities of two samples of nominal 75% Nb–25% Zr alloy were measured below 20°K. The measured conductivities are substantially higher than found previously for segregated Nb–Zr alloys, and the phonon carrier component is found to be completely dominant at all temperatures. The effective number of electrons scattering the phonons is unusually small. (auth)

10376 EFFECTS OF MAGNETIC DOMAINS ON THE SUSCEPTIBILITY OF GADOLINIUM NEAR THE CURIE TEMPERATURE. Sydney, K. R.; Wilson, G. V. H.; Caplin, D. H.; McKenna, T. J. J. Phys., F (London); 4: No. 4, L98-L101(Apr 1974).

The temperature dependence of the ac susceptibility and the coercive field of gadolinium were studied near the Curie temperature. (auth)

10377 PRESENT HEAT RESISTING METALS AND ALLOYS FOR NUCLEAR INDUSTRY. I. Actual Project of Nuclear Iron Making and Problems of Heat Resisting Metals and Alloys. Maeda, T. (Kawasaki Heavy Industries, Ltd., Kobe, Japan). FAPIG (Tokyo); No. 66, 107-116(Aug 1972). (In Japanese).

Results of a study made in the course of HTR material subcommitee activities are presented. Information is included on clarification of the actual state of the concept of nuclear iron making, reasons why temperature at the outlet of helium gas is determined to be 1000°C, critical conditions under which heat resisting metals and alloys can be employed in heat exchangers, and metals and alloys suitable for this application. The materials designated by HTR commitee are Incoloy 800, Inconel 600, HK40, and Hastelloy X to be evaluated for (a) high temperature strength, (b) thermal properties, (c) hydrogen permeability, absorption, and embrittlement, (d) corrosion due to impurities in helium, and (e) manufacture and application problems. The relationship between the coolant outlet temperature and requirements for various industries, possibility of feeding energy from nuclear power plants to iron works, and fundamental flow charts for iron works are explained. Direct reduction processes such as H-iron, CSM, Aachen T. H., Purofer processes are illustrated. When the helium gas outlet temperature is 900°C, the gas can be applied to the production of reduction gas and the technique of present blast furnace process; when 1000°C, to the technique of the direct reduction process; when in the range between 1000 and 1200°C, to the integrated iron and

steel plant complex, therefore the appropriate temperature for multipurpose HTRs may be 1000°C in common use. Creep rupture strength of the representative heat resisting alloys at 1000°C for 10^5 hours is estimated on iron base alloys and nickel base alloys. If the heat resisting alloys are improved in near future, the the strength should be 1.0 kg/mm^2 for forging alloys and 2.0 kg/mm^2 for casting alloys. (JA)

10378 ULTRASONIC MEASUREMENTS OF YOUNG'S MODULUS AND EXTENSIONAL WAVE ATTENUATION IN REFRACTORY METAL WIRES AT ELEVATED TEMPERATURES WITH APPLICATION TO ULTRASONIC THERMOMETRY. Papadakis, E.P.; Fowler, K.A.; Lynnworth, L.C. (Panametrics, Incorporated, Waltham, Massachusetts 02154); Robertson, A.; Zysk, E.D. J. Appl. Phys. 45: No. 6, 2409-2420 (June 1974).

Ultrasonic velocity and attenuation measurements have been made by traveling-wave methods on several refractory metals and their alloys. Broad-band pulses centered around 120 kHz were used for extensional waves (and some torsional waves) in wire specimens. Elastic moduli calculated from the velocities decrease with increasing temperature; the slope increases in magnitude at about half the absolute melting point. At the same point, the attenuation begins to increase rapidly and peaks 300–600°C above the breakpoint. These effects are ascribed to absorption in grain boundaries. The transit time versus temperature in rhenium wire has been calibrated for the use of rhenium as an ultrasonic thermometer sensor. Ultrasonic thermometry above 2000°C is an application of the present measurements. (auth)

10379 STRUCTURE OF CERIUM METAL AT HIGH PRESSURE. Ellinger, F.H. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544); Zachariasen, W.H. Phys. Rev. Lett. 32: No. 14, 773-774 (8 Apr 1974).

The high-pressure form of cerium metal stable above 56 kbar is found to be orthorhombic with the α-uranium type of structure. The effective metallic radius and the observed compressibility correspond to full tetravalency for cerium. A second, metastable form of cerium metal with a monoclinic structure has also been observed above 60 kbar. (auth)

10380 ANGULAR DISTRIBUTIONS OF ELECTRON-STIMULATED-DESORPTION IONS: OXYGEN ON W(100). Czyzewski, J.J.; Madey, T.E.; Yates, J.T. Jr. (Surface Chemistry Section, National Bureau of Standards, Washington, D. C. 20234). Phys. Rev. Lett. 32: No. 14, 777-780 (8 Apr 1974).

Ions liberated from an adsorbed layer by electron-stimulated desorption are shown to have sharply peaked, symmetric angular distributions which are in registry with the substrate. We propose a new method for investigation of the symmetry of binding sites for adsorbed species. (auth)

10381 INFLUENCE OF THE CRYSTALLINE ELECTRIC FIELD ON THE HEAT CAPACITY AND RESISTIVITY OF $PrAl_3$. Mahoney, J.V.; Wallace, W.E.; Craig, R.S. (Department of Chemistry, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). J. Appl. Phys. 45: No. 6, 2733-2738 (June 1974).

Results of heat-capacity and resistivity measurements performed on $PrAl_3$ between 1.5 and 300 K are utilized to reveal and characterize the influence of the crystalline electric field on the ground-state multiplet of Pr^{+3} in $PrAl_3$. Also reported are the results of heat-capacity measurements on the isostructural nonmagnetic counterpart $LaAl_3$ for which there are only vibrational and electronic contributions to C_p. Below 180 K, the excess heat capacity of $PrAl_3$ over that of $LaAl_3$ exhibits of Schottky-type thermal anomaly peaking at 25 K and is attributable to excitation within the crystal-field states. Resistivity results indicate a temperature-dependent spin-disorder contribution at low temperatures associated with the splitting of the ground-state multiplet by the crystal field. The higher-temperature resistivity behavior is observed to be a linear function of temperature and can be readily assigned to phonon contribution. The crystal-field interaction is analyzed using the crystal-field Hamiltonian, $H_{CF}=W_{246}$ $(1-|y|)O_2/F_2+y\,[xO_4/F_4+(1-|x|)O_6/F_6]$, which incorporates a second-order term to account for the nonideal crystallographic c/a ratio exhibited by $PrAl_3$. Best agreement between experimental and calculated heat capacity, resistivity, and susceptibility was obtained using the parameters $x=-0.60$ and $y=0.65$ with a positive value of W_{246}. A singlet ground state results with an over-all splitting of the crystal-field levels of 132 K. The parameters x and y are in reasonable agreement with calculations based on the point-charge model. (auth)

10382 IMAGE CONTRAST OF DISLOCATION LOOPS IN BCC METALS. Ohr, S. M. (Oak Ridge National Lab., Tenn.). Nucl. Met., Met. Soc. AIME; 18: 62-68(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Electron microscope image contrast for small dislocation loops in Nb was calculated from the dynamical theory of electron diffraction using the displacement field corresponding to both prismatic and shear components of the Burgers vector. For dynamical diffraction conditions, in addition to the usual black-white contrast, some loops show a triple white-black-white or a black-white-black contrast depending on the depth and the orientation of the loop. Results indicate that care should be taken in determining the vacancy or interstitial nature of dislocation loops in irradiated bcc metals. (auth)

10383 QUENCHED-IN DEFECTS IN TUNGSTEN. Schultz, H. (Max-Planck-Institut fuer Mettalforschung, Stuttgart). Nucl. Met., Met. Soc. AIME; 18: 394-419(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

A review is presented of quenching and annealing experiments on tungsten. Quenching of tungsten can be carried out with different techniques: in superfluid helium, in vacuum by radiation cooling, or in a bath of a low melting point alloy. The sample purity is the most important parameter for successful quenching; vacancies appear to be trapped by impurity atoms during the quench. The use of superfluid helium quench combined with resistance measurements is a fast technique; many quenches and measurements can be carried out on the same sample, in a short time, in a high-purity environment. The Arrhenius plot of the quenched-in resistance yields an experimental activation energy of 3.3 to 3.7 eV. Corrections were made: (1) extrapolation to infinite quenching speed; (2) size-effect correction. Values near 2 eV appear appropriate for the effective migration enthalpy. Isothermal annealing curves are S-shaped in the beginning, pointing to defect agglomeration. (42 references) (auth)

10384 STUDY OF VACANCY DEFECTS IN QUENCHED TUNGSTEN BY COMBINED ELECTRICAL RESISTIVITY AND FIELD ION MICROSCOPY. Park, J. Y.; Huang, H. C. W.; Berger, A. S.; Balluffi, R. W. (Cornell Univ., Ithaca, NY). Nucl. Met., Met. Soc. AIME; 18: 420-439(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

High-purity single-crystal tungsten wires were prepared by electron beam melting and electropolishing, and then heated resistively in an ultra high vacuum manifold and "radiation quenched" by switching off the heating current. Initial quench rates as large as ~30,000 K sec^{-1} were achieved. No significant changes were found in the annealed specimen base resistance at 4.2°K as a result of multiple quenching and annealing cycles. This quenching method is an ultra-clean technique which maintained the specimen free of impurities during quenching. Appreciable quenched-in resistivity increments were obtained in all cases by quenching from 2700 to 3565°K. However, the increments quenched into one specimen were lower by a factor ~4 than those obtained in another specimen subjected to less initial purification. Furthermore, the increments obtained by extrapolation to infinity quenching rate were smaller by a factor ~3 than those obtained previously by Gripshover, et al. by a similar extrapolation procedure. These differences cannot be due to intrinsic quenched-in vacancy defects, but to the presence of relatively large concentrations of quenched-in impurities (along with vacancies) in all of the specimens with the possible exception of the most pure specimen used in the present work. Field ion microscope (FIM) specimens were examined atom by atom by the method of pulsed field evaporation for the presence of quenched-in defects. 778,000 sites were examined in one relatively impure specimen quenched from 3300°K. Eighteen dark spot defects were found which could have been either vacancies or impurity atoms, establishing an upper limit of $\sim 2 \times 10^{-5}$ for the concentration of quenched-in vacant sites. (10 figures) (auth)

10385 QUENCHED VACANCIES AND THEIR BEHAVIOR IN QUENCHED MOLYBDENUM. Suezawa, M.; Kimura, H. (Tohoku Univ., Sendai). Nucl. Met., Met. Soc. AIME; 18: 440-454 (1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Quenched-in resistivities as a function of the quenching temperature and their annealing have been investigated with specially prepared high-purity molybdenum wire, and the results interpreted reasonably only in terms of quenched-in vacancies. The activation energy for the annealing was determined to be (1.62 ± 0.27) eV and tentatively considered to be the activation energy for migration of a single vacancy. With this value of migration energy, the loss of vacancies during quenching was discussed and the loss at the surface is found predominant. With the correction to the loss the formation energy of a vacancy was recalculated to be (3.24 ± 0.09) eV. The behavior of vacancies during quenching in impure specimens is the main concern of the present

report. Internal sinks for vacancies, such as inclusions and voids, are the main cause of the inefficient quenching of vacancies. Very small grain size and possibly high dislocation density would also cause the appreciable loss of vacancies. The residual resistivity ratio cannot be enough criterion for the purity of specimen to be employed in quenching experiments. (auth)

10386 QUENCHING EXPERIMENTS WITH HIGH PURITY IRON. Wever, H.; Seith, W. (Technische Univ., Berlin). Nucl. Met., Met. Soc. AIME; 18: 455-479(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Wires of high-purity Fe were quenched from temperatures up to 1430°C with various quenching rates. It appeared that with a carbon content of 1.5 at. ppM, the two stages between 60 and 150°C and between 180 and 300°C which were observed earlier do not exist. With a carbon content of 10 at. ppM, however, the two stages are still observed even with quenching rates down to 10 k/sec. This proves that these stages cannot be caused by the migration of vacancies. In slight variation of the interpretation of similar stages observed by Fujita and Damask in Fe with about 500 ppM C it is suggested that in the first stage carbon within the strain field of dislocations migrates to precipitations of ϵ-carbide. These precipitations are dissolved again with rising temperatures beginning at 150°C. The second stage is caused by competitive precipitation of Fe_2C which dissolves also with rising temperatures between 300 and 500°C. For quenching temperatures of 1100 and 1430°C, the height of the first stage increases with quenching rate. It is suggested that this is caused by quenching in dissolved oxygen which precipitates within the temperature range of the first stage. With increasing quenching rate during the α-γ-transformation dislocations are formed which recover again between 750 and 400°C. It was not possible to quench in vacancies. Therefore for vacancies the formation enthalpy has to be >1.7 eV and the migration enthalpy <0.95 eV. (19 figures, 29 references) (auth)

10387 THEORY OF DIFFUSE X-RAY SCATTERING BY INTERSTITIALS IN BCC METALS. Benedek, R. (Cornell Univ., Ithica, NY); Ho, P. S. Nucl. Met., Met. Soc. AIME; 18: 480-492 (1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Starting with a Green's function lattice statics approach, an expression is derived for the diffuse x-ray scattering cross section of interstitials in cubic metals. Numerical calculations were performed, based on interatomic potentials for tungsten, for the six possible geometrical configurations of an intrinsic interstitial in a bcc metal. The relevance of such calculations to the problem of determining the stable form of the interstitial is discussed. (auth)

10388 ANNEALING KINETICS. Johnson, R. A. (Univ., of Virginia, Charlottesville). Nucl. Met., Met. Soc. AIME; 18: 565-580(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Annealing can be an extremely complex phenomenon with many different reactions taking place, and thus many physical parameters can have an effect on the annealing process. In order to obtain unique results from experimental data, a small set of reactions are normally assumed to be rate controlling and all other possible reactions neglected. With this approximation, the procedures for kinetic analysis of the data have become quite standardized. This approximation is tested by running "computer experiments" of situations with many reactions in which the output is in the form of isothermal or isochronal data. The computer is used to solve the large set of coupled differential equations arising from the assumed reactions. The data are then analyzed by standard techniques to obtain "effective" activation energies. Under a broad range of parameter variation, it is found that these effective activation energies do not correspond well with the input activation energies for the calculation. The primary conclusion is that clustering can play a far more important role in annealing than previously realized. (auth)

10389 PRESSURE-VESSELS STEELS: PROMISE AND PROBLEM. Gross, J. H. (United States Steel Corp., Monroeville, PA). pp 11-19 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From second international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

During the past 25 years, numerous pressure-vessel problems have been solved, but in many instances the solutions have led to other problems. Currently, promising developments in pressure-vessel steels are providing such solutions and such additional problems with respect to fabrication and various failure modes. With respect to fabrication, lamellar tearing is being minimized by special melting and solidification practices. However, continuous casting and electroslag-remelting of slabs are currently limited in plate size that can be produced. With respect to bursting, recent studies indicate that high-yield-strength steels have higher burst-strength indices than lower-strength steels even for vessels with nozzles and with notches up to 25 percent of the wall thickness. Strength and therefore resistance to bursting can be increased without loss in toughness through new control-rolling practices, except that these practices are limited to plates up to $\frac{3}{4}$-inch thick. New high-toughness line-pipe steels are now available that should be very attractive for pressure vessels that require very high resistance to shear tearing. These low-sulfur steels may be somewhat impaired by sensitivity to splitting as a result of the control-rolling practice. To date, steels have not been developed with improved resistance to fatigue failure. Fortunately, pressure vessels have rarely failed by fatigue. Similarly, resistance to failure by environmental effects is not basically improved by steel composition. This is usually the result of difficulty in defining the effects of the numerous environments that may be involved. These steel developments promise continued improvement of pressure-vessel performance, but usually are accompanied by problems that present new technological challenges. (auth)

10390 NICKEL-CHROMIUM-MOLYBDENUM STEEL PLATE FOR PRESSURE VESSELS. Sterne, R. H. Jr.; Keay, L. K. (Lukens Steel Co., Coatesville, PA). pp 255-270 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

The Ni-Cr-Mo quenched and tempered plate steels, HY 80, HY 100 and ASTM A543, are surveyed as a material for heavy wall pressure vessels. Manufacture of the steel is described and properties at both low and elevated temperatures are given. Fabrication characteristics are reviewed with data for both submerged arc and electroslag welding. (auth)

10391 QUENCHED AND TEMPERED STEELS FOR PRESSURE VESSEL SERVICE AT ELEVATED TEMPERATURES. Smith, G. V. (Consulting Engineer, Ithaca, NY). pp 273-296 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

The growing trend to the use of quenched and tempered steels in pressure vessels at elevated temperatures is discussed. Their most important advantage being higher strength, it is natural that principal attention be devoted to the strength properties. Brief consideration is also given to two other problem areas of concern, namely embrittlement tendencies and environmental effects. Limitations of space preclude consideration of other aspects of possible interest in the application of quenched and tempered steels to pressure vessels, e.g. improved toughness. Of the individual quenched and tempered steels, $2\frac{1}{4}$ Cr-1 Mo steel has received by far the greatest attention. This emphasis reflects a number of virtues which it possesses, and the demanding service conditions, extending into the lower limits of the creep range, for which it is being applied or considered. (auth)

10392 SURVEY OF STRUCTURAL STEELS FROM 100 TO 150 KSI. Yorke, D. G. (Ebasco Services, Inc., New York). pp 299-333 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-721003-P3.

Data and information on properties of high-strength steels are presented. Data are included on mechanical properties at cryogenic to elevated temperatures. Other data and information are included on toughness, tensile strength, fatigue, and fracture properties. (JRD)

10393 EFFECT OF THICKNESS ON THE TENSILE AND IMPACT PROPERTIES OF HEAVY SECTION PRESSURE VESSEL STEELS. Hodge, J. M. pp 335-337 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

An analysis of data is presented on tensile properties and toughness of A533B steel plates 6 to 12 in. in thickness. (JRD)

10394 DEFINITION OF STRESS INTENSITY FACTORS IN CRACKED PLATES AND SHELLS. Radenkovic, D. (Ecole Polytechnique, Paris); Bergez, D. pp 345-348 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

An analysis is presented of the critical length of cracks in pressure vessels as related to geometry and loading. Discussions are included on the effects of varying stresses in the vicinity of the crack, mechanics of crack growth, and effects of vessel geometry. (JRD)

10395 THERMAL DESORPTION OF LANTHANIDE ATOMS AND IONS FROM THE SURFACE OF TUNGSTEN. Medvedev, B.K.; Ionov, N.I.; Belyakov, Y.I. (A. A. Zhdanov Leningrad State University). Sov. Phys.-Solid State 15: No. 9, 1743-1746 (Mar 1974).

Modulation of the adsorbent temperature was used to determine experimentally the heat of desorption l_0 and the preexponential factor D in the kinetic equation describing the desorption of atoms of 13 lanthanides. The heats of desorption of positive atomic lanthanide ions were calculated from the experimental values of l_0 by means of the Schottky relationship. A periodicity was observed in the dependence of l_0 on the atomic number. (auth)

10396 CHARACTERISTICS OF THE 4d X-RAY EMISSION SPECTRA OF RARE-EARTH METALS IN THE LANTHANUM GROUP. Zimkina, T.M.; Fomichev, V.A.; Gribovskii, S.A. (A. A. Zhdanov Leningrad State University). Sov. Phys.-Solid State 15: No. 9, 1786-1788 (Mar 1974).

An analysis is given of the ultrasoft x-ray emission spectra of rare-earth metals from La (Z=57) to Lu (Z=71), obtained in the range 70-200 eV corresponding to the binding energies of the 4d electrons in the atoms of these elements. The 4d emission spectra of rare-earth metals extend over about 50 eV due to the transitions of the electrons from the $5p^6$ and $4f^n$ subshells to a vacancy in 4d subshell. These spectra have a complex multiplet structure resulting from a strong exchange interaction between a vacancy in the 4d subshell and the partly filled $4f^n$ subshell in a rare-earth atom. An analysis reveals a regular fall in the intensity of the 4d-5p transitions and an increase in the intensity of the 4d-4f transitions with increasing atomic number in the rare-earth element series. (auth)

10397 TRANSVERSE MAGNETORESISTANCE OF FILAMENTARY CADMIUM CRYSTALS AT T=4.2°K. Gaidukov, Y.P.; Danilova, N.P. (M. V. Lomonosov Moscow State University). Sov. Phys.-Solid State 15: No. 9, 1867-1868 (Mar 1974).

Transverse magnetoresistance of Cd whiskers and platelets was measured in magnetic fields up to 70 kOe by the Coleman-Sears method. Electron scattering mechanisms in the weak and strong field regions are discussed taking into account the size effect and specular and diffuse reflections from the surface. (auth)

10398 EXCHANGE INTERACTION AND CRYSTAL LATTICE OF GADOLINIUM-LANTHANUM ALLOYS. Beznosov, A.B.; Nikol'skii, G.S. (Physicotechnical Institute of Low Temperatures, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.-Solid State 15: No. 9, 1873-1874 (Mar 1974).

X-ray measurements of lattice parameters and the temperature dependence of magnetization have been obtained for polycrystalline disordered solid solutions containing 3,4,5,7 and 10 wt.% La in Gd. Curie temperatures for these alloys are reported and exchange interaction constants are derived from observed atomic volume variations. (auth)

10399 X-RAY $N_{4,5}$ EMISSION SPECTRA OF ERBIUM, THULIUM, YTTERBIUM, AND LUTETIUM. Fomichev, V.A.; Gribovskii, S.A.; Zimkina, T.M. (A.A. Zhdanov Leningrad State University). Sov. Phys.-Solid State 15: No. 9, 1880-1881 (Mar 1974).

The x-ray $N_{4,5}$ emission spectra of electron bombarded Er, Tm, Yb, and Lu films are reported and energy levels corresponding to the observed transitions are tabulated. (auth)

10400 ALLOYING OF WELD METAL WITH BORON. Yuzvenko, Yu. A.; Mozok, V. M.; Pavlova, T. A. (Inst. of Electric Welding, Kiev). Avtomat. Svarka; No. 6, 51-53(Jun 1973). (In Russian).

Some questions on the alloying of B with high-chromium alloys and the effect of B on the resistance to wear of the weld metal were examined. Both laboratory and operational testing confirmed the merits of alloying with about 3% B with concentrations of C and Cr of 0.6 to 1.0% and 15 to 20% respectively. (tr-auth)

10401 VACANCY MIGRATION IN B.C.C. TRANSITION METALS. Schultz, H. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Scr. Met.; 8: No. 6, 721-726(Jun 1974).

From Flynn's theory, it is suggested that the vacancy migration in the group V metals V, Nb, Ta, and Fe should occur at low equivalent temperatures, and that the activation enthalpy of migration should be low in these metals, in contrast to the group VI metals Cr, Mo, and W. Experimental data support these predictions. (34 references) (DLC)

10402 CORRELATION BETWEEN ALLOY SOFTENING AND THE STRAIN-RATE SENSITIVITY IN V-Ti ALLOYS. Pink, E.; Stuewe, H. P. (Erich-Schmid-Institut fuer Festkoerperphysik, Leoben, Austria). Scr. Met.; 8: No. 6, 733-738(Jun 1974).

The direct correlation between alloy softening and strain rate sensitivity is shown to hold only when the deformation mechanism is not altered due to alloying. In V-Ti alloys (0.8, 1.7, and 4.3 at. % Ti), it is not possible to establish correlations between tau, lambda, and d(tau)/dT which are valid over the entire temperature range. Alloy softening in one type of alloy is due to a change of deformation mechanism and not to substitutional-interstitial interactions. (DLC)

10403 GASEOUS HYDROGEN ASSISTED CRACK GROWTH IN 18 NICKEL MARAGING STEELS. Gangloff, R. P.; Wei, R. P. (Lehigh Univ., Bethlehem, PA). Scr. Met.; 8: No. 6, 661-667(Jun 1974).

A study was made of the effects of temperature, stress intensity, and alloy composition or strength on the kinetics of sustained-load crack growth in gaseous H for two grades (18 Ni (200) and 18 Ni (250)) of 18 Ni maraging steel. Both steels showed K-independent (Stage II) sustained-load crack growth; 18 Ni (200) was found to be less susceptible to gaseous H embrittlement than the higher strength 18 Ni (250). Stage II crack growth at low temperatures is rate-limited by a process with an activation energy of 18 kJ/mole; at higher temperatures, the susceptibility decreases dramatically over a 5°C range. (DLC)

10404 TRANSMISSION ELECTRON MICROSCOPY OF INCOLOY ALLOY 901. Hays, C. (Texas A and M Univ., College Station); Nail, D. A. Metallography; 7: No. 1, 59-68(Feb 1974).

A description is given of the techniques for producing electron-transparent specimens from stress rupture samples of Incoloy 901 in the transverse direction. Included is a discussion of all important operations involving sectioning, grinding, and polishing. Some typical results are also illustrated. (6 fig.) (auth)

10405 MICROSTRUCTURAL STUDY OF OCCLUSIONS IN WSe_2. Sproul, W. D.; Richman, M. H. (Brown Univ., Providence). Metallography; 7: No. 1, 37-46(Feb 1974).

Transmission electron microscopy and electron diffraction studies were performed on single crystals of WSe_2. It was observed that sample preparation has a great effect on the microstructure. Occlusions, which can be formed by both annealing and cold working, are not stable and will revert to the more stable WSe_2 if heated to high enough temperatures. A possible crystal structure is proposed for the occlusions. (9 fig.) (auth)

10406 BRIGHT FIELD GRAIN BOUNDARY ETCHING TECHNIQUES FOR ALPHA AND DELTA-PHASE PLUTONIUM. Bayer, P. D.; Lawrence, G. D.; White, J. S. (Atomic Weapons Research Establishment, Aldermaston, Eng.). Metallography; 7: No. 1, 19-27(Feb 1974).

A method for producing a uniform cathodically etched structure on plutonium-alloy specimens mounted in conventional plastic or epoxy resin mounting compounds is described. This technique was developed because of the advantage of using a dry-etching technique in the closed environment of a glove box. In addition, an electro-mechanical-etching technique is described which gives a bright field grain boundary etch with unalloyed plutonium and many of its alloys. In this method, specimens are electro-etched and concurrently polished on a rotating wheel. One electrolyte was found satisfactory for all the materials investigated, though for optimum results the etching voltage needs to be varied depending upon the specimen composition. (7 fig.) (auth)

10407 EFFECT OF AN INTERCRITICAL HEAT TREATMENT ON TEMPER EMBRITTLEMENT OF A Ni-Cr-Mo-V ROTOR STEEL. Wada, T.; Doane, D. V. (Climax Molybdenum Co. of Michigan, Ann Arbor). Met. Trans., vp(Jan 1974).

The effect was investigated for a rotor steel containing 0.25% C, 3.5% Ni, 1.7% Cr, 0.5% Mo, 0.1% V, and deliberate additions of P, Sn, or Sb. Both martensitic and bainitic steels were held at the intercritical temperature of 750°C for times up to 40 h and were then quenched or cooled to obtain martensitic or bainitic transformation. The steels were then tempered, followed by water quenching or step cooling from the tempering temperature. The residual ferrite maintained a fine plate-like shape even after 40 h at the intercritical temperature. Embrittlement induced by step cooling from the final tempering was markedly reduced by the intercritical treatment as compared to the embrittlement observed after conventional heat treatment; for example, ΔFATT, the increase in the Charpy V-notch 50% shear fracture transition

temperature caused by step cooling, was reduced by at least 45°C as a result of the intercritical treatment of steels containing 0.02% P. Mo effectively reduced ΔFATT in intercritically heat-treated steels as well as in conventionally treated steels. Possible mechanisms for reducing temper embrittlement with the intercritical treatment are discussed. (5 tables, 29 references, 7 fig.) (auth)

10408 CYCLOTRON MASSES AND MASS ENHANCEMENTS IN GADOLINIUM. Young, R. C.; Hulbert, J. K. (Univ. of Birmingham, Eng.). Phys. Lett.; 47A: No. 5, 367-368(22 Apr 1974).

Cyclotron masses of several orbits on the Fermi surface of gadolinium were determined by the Haas-van Alphen effect. They are larger than the masses predicted from the RAPW band structure by a consistent factor of about 2.4. (auth)

10409 X-RAY SPECTRA, L-SUBSHELL FLUORESCENCE, AND COSTER-KRONIG YIELDS IN BISMUTH AND NEPTUNIUM. Weksler, M.; de Pinho, A. G. (Pontificia Univ. Catolica, Rio de Janeiro). Rev. Brasil. Fis.; 3: No. 2, 291-309(Oct 1973).

The Bi L x-ray spectrum from the decay of ^{210}Pb and the Np L x-ray spectrum from the decay of ^{241}Am were measured at high resolution with a Si(Li) spectrometer. From these data, values for the L-subshell fluorescence, Coster-Kronig and Auger yields in Bi and Np were derived. (INIS)

10410 RETARDATION OF THE RECRYSTALLIZATION OF TUNGSTEN WIRE IN Ni AND NiCr-MATRIX. Gruenling, H.; Hofer, G. (Kraftwerk Union AG, Erlangen, Ger.). Z. Werkstofftech.; 5: No. 2, 69-72(Mar 1974). (In German).

From meeting: composite materials; Konstanz, Germany (28 Mar 1974).

Nickel and other metals are known to reduce the recrystallization temperature of doped tungsten and tungsten-2% thorium oxide. This effect and its retardation were investigated within the framework of a more comprehensive study of fiber reinforced materials. (GE)

10411 KINETICS OF THE ISOTHERMAL NITROGEN-GASSING AND -DEGASSING OF VA-METALS. Gruenwald, W.; Haessner, F.; Hemminger, W.; Lukas, H. L. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Z. Metallk.; 65: No. 2, 184-190 (Mar 1974). (In German).

The nitrogen-gassing and -degassing process of thin samples of the VA-group metals is treated theoretically with respect to the process parameters such as gas-pressure and pumping-speed. Theoretical concentration-time-curves are calculated, partly with the aid of derived analytical functions, partly numerically by means of a computer. The concentration-time-curves are compared with published experimental data and a curve resulting from an approximation formula given in the literature. (GE)

10412 TORSIONAL CYCLING OF COLD PRESSURE WELDED ZIRCONIUM/STEEL-SPECIMENS. Rie, K. T. (Technische Univ., Univ., Brunswick); Ruge, J. Z. Werkstofftech.; 5: No. 2, 72-77 (Mar 1974). (In German).

Low-cycle fatigue of cold pressure welded zirconium/steel-specimens has been studied under cyclic torsion. The critical number of cycles N_{C_r} instead of the number of cycles to final failure N_f is taken for evaluation of the endurance life in low-cycle fatigue. N_{C_r} is defined as the number of cycles leading to the formation of a crack which noticeably weakens the specimen. The relationship $N_{C_r}^{\alpha} \times \Delta\gamma = \text{const.}$ is achieved for bonded specimens. The results have been correlated with the observations in unwelded zirconium and steel to predict the endurance life of bonded specimens. Microstructure studies revealed crack initiation at points of intense slip in zirconium. Fracture occured always in zirconium outside the welded zone. (GE)

10413 CRYSTAL STRUCTURES, HOMOGENEITY RANGES, AND MAGNETIC PROPERTIES OF Ta-Co LAVES PHASES. Itoh, H.; Aoki, Y.; Nakamichi, T.; Yamamoto, M. (Tohoku Univ., Sendai). Z. Metallk.; 65: No. 2, 149-157(Feb 1974).

The crystal structures, homogeneity ranges, and magnetic properties of the three Laves phases in the tantalum-cobalt alloy system have been studied with the aid of the x-ray powder photographs and density and magnetic measurements. The hexagonal $MgNi_2$-type $TaCo_2$ compound with the homogeneity range of about 25.5 to 27.0 at. % Ta, is ferromagnetic with Curie temperatures lower than 19°K and saturation magnetizations at 4.2°K less than 3.58 emu/g. The cubic $MgCu_2$-type one is paramagnetic down to 4.2°K over the whole homogeneity range of about 28.5 to 33.3 at. % Ta. If a relatively strong temperature-dependent magnetic susceptibility of the stoichiometric composition in this compound is analyzed as the band paramagnetism, excess cobalt atoms seem to have very small localized moments in the non-stoichiometric one. Around 40.0 at. % Ta one observed a hexagonal $MgZn_2$-type which shows Pauli-paramagnetism with the smallest magnetic susceptibility among the three Laves phases. phases. (GE)

10414 HEAT CAPACITY OF LIQUID CADMIUM-ANTIMONY ALLOYS. Schick, G.; Komarek, K. L. (New York Univ., NY). Z. Metallk.; 65: No. 2, 112-118(Feb 1974).

The heat capacities of liquid cadmium-antimony alloys were determined by constant temperature gradient calorimetry between the liquidus curve and 630°C. The C_p vs. temperature curves between 30 and 70 at. % Cd consist of two intersecting straight lines with different negative slopes. Below the intersection the C_p isotherms exhibit a very pronounced positive deviation from Neumann-Kopp rule with a maximum at 57 at. % Cd (Cd_4Sb_3). Above the intersection the heat capacities of liquid cadmium-antimony alloys are additive. The strong positive deviation of C_p at lower temperatures is interpreted as being due to the presence of Cd_4Sb_3-clusters in the melt which dissociate as the temperature is raised. (GE)

10415 Ti-Al-Nb-ALLOY FOR USE AT 750°C. Ahlborn, H.; Track, W.; Winter, H. (Battelle-Institut eV, Frankfurt am Main). Z. Metallk.; 65: No. 2, 89-93(Feb 1974). (In German).

The development of a high-temperature titanium alloy on the basis of titanium-aluminum-niobium is described. The evaluation of hot hardness, elevated-temperature tensile strength, creep properties and oxidation resistance of alloys on the quasi-binary section Ti-$NbAl_3$ with aluminum contents between 12 and 17.5 wt % resulted in the composition (in wt %): Ti-15.5 Al-18 Nb-1.5 Hf-0.5 Si with optimal properties. The 1000 h stress rupture values reached were 43 kg/mm^2 at 600°C and 18 kg/mm^2 at 750°C. The presently rather poor room-temperature ductility can probably be improved by using an optimum aluminum content. (GE)

10416 THERMODYNAMIC INVESTIGATIONS IN THE Au-Cd SYSTEM. II. Komarek, K. L.; Reiffenstein, E.; Stummerer, G. (Univ., Vienna). Monatsh. Chem.; 104: No. 6, 1570-1585(Nov 1973). (In German).

Liquidus and solidus curves of the β-AuCd phase were determined by differential thermal analysis (DTA) measurements. β-AuCd has a congruent melting point of 629.5°C at 47 at.% Cd with no signs of other minima or maxima in the liquidus curve between 43 and 51 at.% Cd. Liquid and solid Au-Cd alloys were investigated by the emf method between 40 and 90 at.% Cd and 653 to 973°K. A consistent set of integral thermodynamic data for liquid and for solid alloys of the entire Au-Cd system were calculated at 1000 and at 700°K, respectively, using values taken from the literature. Partial molar entropies of Cd of solid β-AuCd and of liquid alloys in the same concentrating range were compared and discussed with respect to ordering phenomena in solid and liquid alloys. (auth)

10417 METALLOGRAPHIC ANALYSIS OF FRETTING FATIGUE DAMAGE IN Ti-6Al-4V/MA/ AND 7075-T6 ALUMINUM. Hoeppner, D. W.; Goss, G. L. (Lockheed-California Rye Canyon Research Lab., Burbank). Wear; 27: 175-187(Feb 1974).

Review of the results of fretting fatigue tests performed on titanium Ti-6Al-4V(MA) and aluminum 7075-T6 specimens, with the aim of developing an understanding of cracking in fretting fatigue. The results indicate that: (1) large numbers of secondary cracks are produced in the fretted regions of laboratory fretting fatigue specimens; (2) cracks produced in fretted regions differ in character as a function of applied fatigue stress; and (3) fretting fatigue damage may be related to mechanical action between the contacting surfaces. (IAA)

10418 RECOVERY OF THE MECHANICAL PROPERTIES OF SEVERELY STRAIN HARDENED Nb. Houssin, B.; Fries, J. F.; Cizeron, G.; Lacombe, P. (Paris Univ., Orsay, France). Compt. Rend., Ser. C; 278: No. 4, 227-230(21 Jan 1974). (In French).

Isochronous annealing was used to investigate the recovery of the mechanical properties of three different grades of niobium strain hardened by unidirectional rolling at 20°C. The variations in the elastic limit and rupturing stress produced by annealing samples for 30 minutes at temperatures ranging from 20 to 1000°C are presented, and values given for the elongation as a function of annealing temperature. (FR)

10419 MICROSTRUCTURAL FEATURES OF Cr12NiWMoVTi/T60/ STEEL AFTER ELECTROSLAG REMELTING. Koutsky, J. (SKODA, Plzen, Czech); Brackova, L.; Jezek, J.; Stransky, K. Kovove Mater.; 11: No. 4, 434-437(1973). (In Czech).

10420 STRUKTURA I SVOYSTVA ZHAROPROCHNYKH METALLICHESKIKH MATERIALOV. (Structure and Properties of Heat-Resistant Metallic Materials). Ageyev, N. V.; Savitskii, E. M.; Kornilov, I. I.; Zudin, I. F.; Prokof'ev, D. I. (Eds.). Moscow; Nauka (1973). 262p.

Results are generalized from studies associated with the physical criteria of heat resistance; the role of the electron structure of alloys; the principles of alloying and dispersion hardening of alloys; the physico-chemical basis for developing composite materials; dislocation mechanisms associated with failure and deformation; the development of alloys on the basis of Fe, Ni, Mo, Nb, and other

refractory elements; and ways of increasing the heat resistance of alloys. (JPRS)

10421 NUCLEAR APPLICATIONS OF ZIRCONIUM. Armand, M.; Castro, R. (Ugine Aciers Speciaux, Saint-Denis, France). Rev. Fr. Energ.; 25: No. 257, 229-233(Oct 1973). (In French).

Industrial techniques were developed for the fabrication of zirconium to be used in the construction of nuclear power reactors. The processes involved are recalled together with the specific properties of zirconium in nuclear application, and its principal uses. (FR)

10422 NEW USES OF STEELS IN THE ELECTRICITY PRODUCING INDUSTRIES. Vieillard-Baron, B. (Societe Creusot-Loire, Paris); Bonnard, Y. Rev. Fr. Energ.; 25: No. 257, 211-227(Oct 1973). (In French).

The work undertaken in France by metallurgical societies, the builders of electrical power plants, and plant operators directed toward adapting materials to new uses (such as those of modern installations) is described. Aspects of the adapting of steels to meet the requirements of classical hydraulic and thermal power plants are discussed together with a few general principles which have guided the choice of materials in electronuclear plants. Three examples are presented of the way in which problems encountered in the development of special steels for light water nuclear plants are solved: forged steel for the wall of the reactor vessel; cast steel for the bottom of the steam generator; stainless steels used in the primary circuit. (FR)

10423 X RAY PHOTOELECTRON STUDIES OF THORIUM AND URANIUM. Fuggle, J. C.; Burr, A. F.; Watson, L. M.; Fabian, D. J.; Lang, W. (Strathclyde Univ., Glasgow). J. Phys., F (London); 4: No. 2, 335-342(Feb 1974).

The x ray induced photoemission from both clean and deliberately oxidized thorium and uranium surfaces is described. The results are compared with previously reported x ray photoelectron spectrometry and x ray emission measurements of electron binding energies for the heavy elements. While agreement between photoelectron and x ray spectroscopic results is fair for most of the electron energy levels studied, large discrepancies were observed in the energies of the P_1, P_2, and P_3 levels. The effect of oxidation on the spectra and on the valence bands for the metals is also discussed. (auth)

10424 CALCULATION OF HYDROGEN DIFFUSION IN ZIRCALOY-YTTRIUM LAYERS WITH A GENERALIZED EIGENFUNCTION METHOD. Mertins, H.; Lahann, H. J. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Geesthacht, Ger.). Atomkernenergie; 19: No. 2, 92-96(1972). (In German). (GKSS-72-E-16-(P.1)).

The diffusion of hydrogen in a combination of two metals with different affinity to hydrogen is investigated at constant temperature. Because of the concentration jump at the boundary between the two metals due to the distribution law of Nernst the method of expanding the solution into eigenfunctions of the problem must be generalized towards piecewise continuous eigenfunctions. The solution shows how the hydrogen up take by yttrium depends on the diffusion constants, the distribution coefficient, and the slab-diameters. A method to determine the diffusion constants and the distribution coefficient from experimental curves is presented. (GE)

10425 TOTAL EMISSIVITY OF MOLYBDENUM SAMPLES ROUGHENED BY ELECTRON BEAMS AS A FUNCTION OF THE SURFACE ROUGHNESS. Neuer, G.; Woerner, B. Stuttgart; Univ. Stuttgart (1972). 60p. (In German). (IKE-5-145d).

Thesis.

Molybdenum samples have been roughened by an electron-beam welder in order to ascertain a quantitative relationship between the emissivity and the geometrical parameters for the classification of surfaces, and to develop a suitable procedure for the preparation of reproducible surface roughness. The results of measurements of the total emissivity of the samples perpendicular to the surface and as a function of the emission direction at temperatures between 1350 and 2250°K clearly revealed a systematic pattern. The increase of the emissivity is up to 0.6 for roughened surfaces, and 0.2 for polished surfaces. The technical methods applied for measuring the surface roughness of the samples included a nondestructive and a micrographic method. The values for the total emissivity (as calculated by way of the determined parameters) show a deviation of 5 to 20% from the measured values. (GE)

10426 TECHNOLOGY OF ELECTRIC-ARC BUILDING-UP OF HIGH-BORON ALLOYS. Levitskii, S. N.; Kasumzade, N. G. Svar. Proizv.; No. 4, 30-32(Apr 1973). (In Russian).

In order to increase the durability of rapidly eroding components of petroleum and petrochemical equipment alloys of the ternary system C-B-Fe were investigated. The system was obtained by electric-arc deposition using special powder wires with boron carbide in the mixture. The study made it possible to establish the basic parameters of the fusion region for high-B alloys in order to guarantee obtaining the optimum structure and properties of the fused-on metal and of the zone near the fused-on metal. A technology was developed for the deposition of the high-B alloys. Test samples were coated and showed high reliability in use. (tr-auth)

10427 MECHANICAL PROPERTIES OF MULTICOMPONENT ALLOYS BASED ON α-SOLID SOLUTION OF TITANIUM-ALUMINUM-TIN (ZIRCONIUM) WITH β-STABILIZING ELEMENTS. Mikheev, V. S. Probl. Prochnosti; No. 10, 89-92(Oct 1973). (In Russian).

Results are reported on the mechanical properties of multicomponent titanium alloys based on an α-solid solution from the system Ti-Al-Sn(Zr) and Ti-Al-Sn-Zr, alloyed with Mo, V, Cr, Fe, Si, and B at room temperature in the forged and heat-treated states and at high temperatures (up to 950°C) in the forged state. Optimal compositions of high-strength, ductile and technologically workable multicomponent titanium alloys are determined: 5.5 to 7% Al, 1.5 to 2.5% Sn, 2% Mo, 2% V, 0.3 to 0.5% Cr, 0.10 to 0.20% Fe, 0.3 to 0.5% Si, 0.01% B, or in the case of Zr, 2.5 to 3% Zr (no tin) in a composition totalling 11 to 13% of the same elements. Increasing the aluminum content to 8.9% or the zirconium content to 15% increases the hardness and strength, while reducing plastic properties significantly. Heat treatment is very significant. High temperature annealing (at 1000°C) with subsequent water quenching and tempering at 500°C increases the strength of the alloy with 8.9% Al (total of alloying elements 15.76%) to 170 kg/mm^2, without changing elongation, and increasing the reduction in area. (JPRS)

10428 REVERSIBLE SUSCEPTIBILITIES OF DYSPROSIUM AND TERBIUM. Del Noral, A.; Lee, E. W. (Univ. of Southampton, Eng.). J. Phys., F (London); 4: No. 2, 280-290(Feb 1974).

The initial susceptibilities of Dy and Tb have been measured in the ferromagnetic and antiferromagnetic phases. In the ferromagnetic phase it is concluded that the susceptibility arises from domain wall displacements and that these are limited by an intrinsic resorting force resulting from the very narrow domain wall and not by local impedances due to imperfections and impurities. From measurements in the anti-ferromagnetic phase it is concluded that the often quoted two constant expression for the exchange coupling between sublattices cannot provide a quantitative explanation for the observed behavior but that the susceptibility of Dy and the temperature variation is quantitatively consistent with the seven exchange constants and the turn angles determined from neutron scattering measurements. The reversible susceptibility measured in the presence of external fields shows a complicated behavior and does not appear to be consistent with the predictions of the theory of Nagamiya et al. [Prog. Theor. Phys.; 27: 1253(1962)]. (auth)

10429 HYPERFINE INTERACTION OF HOLMIUM IN FERROMAGNETIC RARE EARTH ALLOYS. Mackenzie, I. S.; McCausland, M. A. H.; Wagg, A. R. (Univ. of Manchester, Eng.). J. Phys., F (London); 4: No. 2, 315-328(Feb 1974).

Spin echo measurements have been made, at liquid helium temperatures, on ^{165}Ho in ferromagnetic alloys of holmium with gadolinium, terbium, and dysprosium. Intra and extraionic contributions to the hyperfine interaction are discussed, with particular emphasis on conduction electron effects. The hyperfine field B_p due to conduction electrons polarized by the parent holmium ion is found to be +12 T, and the field B_n due to conduction electrons polarized by neighboring ions is $-8.3\ \bar{S}$T, where $\bar{S}$ is the mean ionic spin of the alloy. The contributions from individual neighbor ions to B_n are found to be additive and of moderately long range, and to depend only on the spin of the polarizing ion. Electric quadrupole splittings in the Ho-Tb and Ho-Dy alloys indicate that the electric field gradient due to conduction electrons exceeds that due to the ionic lattice by a factor of about seven. (auth)

10430 LOW TEMPERATURE HEAT CAPACITIES OF $DyNi_5$, $HoNi_5$, AND $ErNi_5$. Bechman, C. A.; Wallace, W. E.; Craig, R. S. (Univ. of Pittsburgh). J. Phys. Chem. Solids; 35: No. 3, 463-464(Mar 1974).

Measurements were made on RNi_5 phases with R = Dy, Ho, and Er prepared by induction fusing together the highest purity component metals available commercially. The calorimetric technique is identical with that used earlier [Nasu et al., J. Phys. Chem. Solids; 32: 2779(1971)] with the following exceptions: (1) thermometer calibration was extended so that measurements up to about 15°K could be made and (2) the unit was operated under on-line computer control. Results obtained are shown along with the behavior of $LaNi_5$ determined earlier. Comparison with the heat capacity of $LaNi_5$ shows that the magnetic contribution to the heat capacity is over 90 percent of the total at 4°K for $DyNi_5$, $HoNi_5$ and $ErNi_5$. The implications of this result are discussed. (UK)

10431 TWO INDEPENDENT MAGNETIC SUBLATTICES OF Er IN THE $Er_{5-x}La_xGe_3$ SYSTEM. Felner, I.; Grill, A. (Hebrew Univ., Jerusalem). J. Phys. Chem. Solids; 35: No. 4, 581-584 (Apr 1974).

Magnetic measurements of $Er_{5-x}La_xGe_3$ with $1 \leq x \leq 5$ were made between 4.2°K and room temperature. The compounds crystallize in the hexagonal ($D8_8$) structure (Mn_5Si_3 type) with space group $P6_3/mcm$. Two independent, ferromagnetic and antiferromagnetic, sublattices of Er exist. The magnetic interaction between the Er atoms in the 6(g) sites is ferromagnetic, while that between the Er atoms in the 4(d) sites is antiferromagnetic. The antiferromagnetic exchange interaction is weak in this system. The first and second La atom substitutes into the 6(g) site, while the third La in $Er_2La_3Ge_3$ is located in the 4(d) position. The fourth La is probably substituted in such a manner that all the Er atoms are left in the 6(g) sites. (auth)

10432 LATTICE STATICS CALCULATIONS FOR INTERSTITIAL ATOMS IN TUNGSTEN. Benedek, R.; Ho, P. S. (Cornell Univ., Ithaca, NY). J. Phys., F (London); 4: No. 2, 185-195(Feb 1974).

A modified Green function approach suggested earlier by the authors [Benedek et al., J. Phys. F: Metal Phys.; 3: 1285(1973)] has been applied to the calculation of lattice distortion fields and energies and volumes of formation for six interstitial configurations in tungsten. Two interatomic potentials, one fitted to the phonon spectrum and the other, derived by Johnson and Wilson, to elastic constants, were used in numerical calculations. Results for the energy of formation show considerable sensitivity to the form of the potential, as expected from previous work. An expression is derived for the volume of formation which includes a correction to the standard formula involving the defect strength divided by the bulk modulus. This correction term depends explicitly on the volume dependent part of the crystal energy and vanishes for a Cauchy crystal. Expressions are also derived for the energy and volume of formation of a Frenkel pair. These quantities are somewhat easier to calculate and less sensitive to the form of the potential than those corresponding to interstitials or vacancies individually. (auth)

Radiation Effects

Refer also to abstracts 9359, 10478, 11304, 11537, 11578, and 11947.

10433 (CONF-740615-1) AUGER ELECTRON SPECTROSCOPY OF FRACTURE SURFACES IN IRRADIATED TYPE 304 STAINLESS STEEL. Clausing, R. E.; Bloom, E. E. (Oak Ridge National Lab., Tenn. (USA)). 1973. 12p. Dep. NTIS $4.00.

From 4th Bolton Landing conference, grain boundaries in engineering materials; Bolton Landing, New York, USA (9 Jun 1974).

Auger electron spectroscopy was used to study surfaces in type 304 stainless steel fractured after irradiation at 370°C to $1.4 - 10 \times 10^{22}$ neutrons/cm^2. The irradiated samples failed primarily along grain boundaries, although in some cases areas of ductile transgranular fracture were also present. Helium release during fracture was monitored with a residual gas analyzer. The concentration of He at the boundaries was approximately proportional to the fast neutron fluence to which the samples were irradiated, being about 0.08 He atoms per grain boundary site at 1×10^{23} neutrons/cm^2. Phosphorus was more concentrated at grain boundaries than on ductile fracture surfaces. Sulfur segregated to surfaces during and after the fracture, suggesting that it could segregate to grain boundaries. Grain boundary fracture surfaces of irradiated samples were depleted in Cr and enriched in Fe and Ni compared with ductile fractures of unirradiated samples broken at the same temperature. (auth)

10434 (HEDL-TME-74-9) IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. Semi-Annual Progress Report, August 1973 - January 1974. Claudson, T. T. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Mar 1974. Contract AT(45-1)-2170. 259p. AT.

Results of research on radiation damage in reactor materials and on properties of reactor materials are presented. Most of the effort during the report period was devoted to steels, stainless steels, refractory alloys, and aluminum alloys. The research was conducted by Aerojet Nuclear Company, Argonne National Laboratory, Atomics International, General Electric Company, Hanford Engineering Development Laboratory, Naval Research Laboratory, Oak Ridge National Laboratory, Pacific Northwest Laboratory and University of Cincinnati. (JRD)

10435 (JAPFNR-147) METALLURGICAL MODIFICATION OF AUSTENITIC STAINLESS STEELS FOR USES IN FBR, A PRELIMINARY SURVEY. Fujimura, T.; Kondo, T.; Nakajima, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Feb 1974. 70p. (PNC-N-251-74-8). Dep. NTIS (US Sales Only) $6.50.

For Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan).

An extensive survey and some preliminary experiments were made in order to improve the performance of austenitic stainless steels in service as core component materials. Emphasis is on (1) the loss of high temperature post-irradiation ductility and (2) the swelling due to radiation-induced void formation. The survey was on the basis of empirical knowledge in published literature and experience in thermomechanical treatment of austenitic stainless steels. The experimental phase was directed to the establishment of a technique in analyzing the process of strain-induced carbide precipitation by precision dilatation measurement. Correlation was obtained with electron microscopic observation of carbide precipitates. An effort was also made to confirm the metallurgical character and high-temperature mechanical properties of the reference material which will be compared with post-irradiation tests. (49 figures, 41 references) (DLC)

10436 (LA-5535-C, pp 353-379) THEORY OF THE PRODUCTION OF RADIATION DISPLACEMENT DAMAGE. Oen, O. S. (Oak Ridge National Lab., TN). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

The basis for the modern method of characterizing nascent displacement damage in solids in a unified way by the damage energy is reviewed. The damage energy of a single cascade is the kinetic energy of the primary recoil atom minus the electron excitation losses of all the atoms comprising the cascade. The number of displaced atoms in a cascade is proportional to the damage energy and can be found immediately from it once the displacement threshold energy is known. In neutron irradiation the damage energy averaged over the spectrum of primary energies is a convenient measure of displacement damage as a function of neutron energy. (auth)

10437 NEUTRON IRRADIATION EMBRITTLEMENT OF IRON AND STEEL AND THE LESSER IRRADIATION EMBRITTLEMENT OF IN TREATED STEEL. Igata, N. (Tokyo Univ.); Nakamura, H.; Seto, S. Ishikawajima-Harima Giho; 14: No. 1, 42-50(Jan 1974). (In Japanese).

The problem of irradiation embrittlement or irradiation hardening of steel for nuclear pressure vessels is a matter for serious consideration from an economic as well as safety standpoint in the operation and maintenance of nuclear reactors. Information concerning irradiation hardening and irradiation embrittlement of iron, iron alloy and steel, which are the functions of various factors, i.e., grain size, interstitial impurity contents, substitutional alloying elements, and heat treatment, is summarized. The data on the changes of atomistic structures, such as electrical resistivity, internal friction, and electron microscopy, are also summarized. The mechanism of irradiation hardening or embrittlement is briefly discussed. It is emphasized that the irradiation induced point defects enhance the irradiation hardening or embrittlement when those combine with interstitial nitrogen or carbon atoms to form the complex defects. Recent studies on the effects of nitrogen and aluminum in iron and the irradiation resisting properties of IN treated steels are introduced and the mechanism of irradiation resisting properties of IN steels are discussed. It is concluded that less irradiation embrittlement of the steel for nuclear pressure vessels can be obtained when free nitrogen or carbon atoms are less or scavenged strongly by substitutional elements such as aluminum in IN treated steel. (JA)

10438 ELECTRON RADIATION IN THIN FILMS OF SILVER. Arutyunyan, F. R.; Mkhitaryan, A. Kh.; Oganesyan, R. A.; Rostomyan, B. O. (Inst. of Physical Research, Erevan). Dokl. Akad. Nauk Arm. SSR; 55: No. 5, 286-290(1972). (In Russian).

Experimental results showed that the luminescence of Ag films under the effects of nonrelativistic electrons impinging on the film surface at angles of flight up to $\psi = 75°$ consists almost completely of photons of transition radiation. The experimental data agrees with the predictions from the theory of transition radiation. (JSR)

10439 PHOTON-CHANNELED-ION COINCIDENCE MEASUREMENTS TO INVESTIGATE THE IMPACT-PARAMETER DEPENDENCE OF X-RAY EXCITATION. Ambros, R.; Lutz, H.O.; Reichelt, K. (Kernforschungsanlage Jülich, D-517 Jülich, West Germany, and Universitt Köln, D-5 Köln, West Germany). Phys. Rev. Lett. 32: No. 15, 811-814 (15 Apr 1974).

60-MeV I ions were ejected into the open (111) planar channels of thin Au single crystals. Characteristic I and Au M x rays excited in the crystal field were measured in coincidence with the transmitted ions. The ion energy identified their oscillation amplitude in the channel; this

allowed determination of the impact-parameter dependence of x-ray excitation in small-angle collisions. (auth)

10440 CHANGE OF ELECTRICAL RESISTIVITY OF METAL FILMS BOMBARDED WITH HELIUM IONS OF LOW ENERGY. Nomura, A.; Kanayama, M.; Kiyono, S. (Department of Applied Physics, Faculty of Engineering, Tohoku University, Sendai, Japan). J. Appl. Phys. 45: No. 6, 2394-2395 (June 1974).

Copper and gold evaporated films of thicknesses between 500 and 2500 Å have been bombarded at liquid-nitrogen temperature with 4-10-keV He ion beams. The electrical resistivities of these films increase with dose without saturation, and the values of these changes in the thinner films approach tens of $\mu\Omega$ cm at a dose of 10^{17} ions/cm^2. About 80% of the resistivity changes induced in copper and about 60% of the resistivity changes induced in gold are recovered after annealing to 453 K. The remarkable peaks of the thermal recoveries are mainly observed in stage II. The nature of the evaporated metal films closely relates to the large resistivity changes, which are also affected by bombarding with low-energy ions. (auth)

10441 RADIATION EMBRITTLEMENT RESISTANCE OF ADVANCED Ni-Cr-Mo STEEL PLATES, FORGINGS, AND WELDMENTS. Hawthorne, J. R. (Naval Research Lab., Washington, DC). pp 231-251 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

The 550°F irradiation response characteristics of several NiCrMo steel plates, forgings, and weldments were evaluated. Primary objectives were to explore variable radiation embrittlement tendencies and to assess notch ductility performance relative to that of the MnMoNi steel (ASTM Type A533-B) currently used in nuclear reactor vessel construction. The study was focused on ASTM Type A543 steel in Class 1 and Class 2 heat treatment conditions. Both submerged arc and electroslag weldments were evaluated. Irradiation embrittlement was indexed by the increase in Charpy-V 30 ft-lb transition temperature. Results clearly demonstrate the promise of ASTM Type A543 plate and related A508 forging steels for advanced reactor applications. Both radiation embrittlement resistance and preirradiation transition temperature characteristics were found superior to those of standard production A533-B. With only two exceptions, the A543 plates and A508 forgings exhibited sufficient resistance to a fluence of 4×10^{19} n/cm^2 > 1 MeV to retain a subzero nil ductility transition (NDT) temperature. Weld deposits generally had higher postirradiation transition temperatures than plates. Significant variability in radiation resistance was noted among A543 plates and weld deposits but could be traced in most instances to composition differences, especially residual element content differences. Anomalous weld heat affected zone (HAZ) behavior relative to weld thickness location was observed. A progressive increase in irradiation response with an increase in copper content was found. Vanadium content appears detrimental to radiation resistance of NiCrMo plates, but not to NiCrMo forgings. Weld deposit results infer a harmful effect of nickel content when chromium content is low. Notch ductility recovery by postirradiation heat treatment was also explored. (auth)

10442 DEFECTS AND DEFECT CLUSTERS IN b.c.c. METALS AND THEIR ALLOYS. Proceedings of the 1973 International Conference held at Gaithersburg, Maryland, August 14-16, 1973. Arsenault, R. J. (ed.). Nucl. Met., Met. Soc. AIME; 18: 1-608 (1973). (CONF-730813-).

Thirty-three papers are presented on the effects of defects and defect clusters on the properties of bcc metals and their alloys. The defects and defect clusters are those resulting from neutron and charged particle irradiations and from quenching. A subject index is included. Separate abstracts were prepared for all the papers. (DLC)

For abstracts of individual papers see: 10382-10388, 10443-10467, and 11311.

10443 DEFECT CLUSTERS IN CONNECTION WITH THE PRESENCE OF IMPURITY ATOMS IN NEUTRON IRRADIATED bcc METALS. Hasiguti, R. R. (Tokyo Univ.). Nucl. Met., Met. Soc. AIME; 18: 1-18(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Some of the larger defect clusters are directly observed by transmission electron microscopy. Defect complexes and defect clusters which are too small to be detected by transmission electron microscopy are investigated by various experimental methods, among which Snoek type internal friction measurements are of interest, and the results of this kind of internal friction measurements are discussed in this paper. The formation and the behavior of defect clusters in bcc metals are remarkably influenced by the presence of impurity atoms. The roles of impurity atoms are to act as constituents of complexes or clusters, and/or to act as nucleation centers of cluster formation. Discussions are made in this paper concerning point defect-impurity complexes, point defect clusters which contain impurity atoms, point defect clusters or dislocation loops nucleated at impurity atoms, and gigantic defect clusters which contain impurity atoms. Discussions are made based on mainly Snoek type internal friction measurements and transmission electron microscopic observations. (12 figs, 32 references) (auth)

10444 LOW TEMPERATURE RADIATION EFFECTS ON DEFORMATION CHARACTERISTICS IN IRON. Groh, P.; Vanoni, F.; Moser, P. (CEN, Grenoble, France). Nucl. Met., Met. Soc. AIME; 18: 19-40(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

In order to investigate the interactions between point defects and glide dislocations, high-purity polycrystalline iron was irradiated by neutrons at 77°K (E > 1 MeV; from 5×10^{15} to 5×10^{18} n/cm^2 and by electrons at 20°K (E = 3 MeV, from 10^{17} to 5×10^{18} e/cm^2). Such irradiated specimens and postirradiation annealed ones were tensile tested at 77°K. The annealing temperatures ranged between 90 to 650°K. Defects resulting from such irradiations strongly affect the low-temperature deformation characteristics of iron; mechanical twinning is suppressed for point defect concentrations in the 10-1000 ppM range. Postannealing experiments show that, in electron-irradiated specimens, the initial properties are completely recovered in a monotonous single stage at 130 to 180°K, while after neutron irradiation, the recovery is more complex with two stages of radiation anneal hardening at 130-180°K and 250-350°K. These results are interpreted in terms of interactions between isolated point defects or their clusters and the screw dislocations which control the plastic deformation. Any significant contribution of residual interstitial impurities to the above phenomena was ruled out. (12 figs, 67 references) (auth)

10445 NEUTRON IRRADIATION SOFTENING AND THE EFFECT OF INTERSTITIALS IN STRENGTHENING. Arsenault, R. J.; Cadman, T. (Univ. of Maryland, College Park). Nucl. Met., Met. Soc. AIME; 18: 41-61(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

It has been shown that impurity interstitials have a very large effect on change on the effective stress of neutron-irradiated bcc metals. The reasons why or how the impurity interstitials play this role remains a mystery. Also, it has been observed that neutron irradiation of high-purity bcc metals can result in a reduction of the effective stress. A computer simulation model was developed to determine how the self-interstitials, vacancies, or both self-interstitials and vacancies can lead to reduction of the effective stress. For the realistic case of both vacancies and interstitials present in an irradiated metal, there can be a minimum in the yield stress vs defect concentration relationship. The magnitude of decrease in the yield stress and defect concentration where this occurs depends upon several parameters. A decrease in the percentage of vacancies results in a large decrease in the yield stress. Increasing the slip plane width causes the minimum to occur at a lower defect concentration. (13 figures) (auth)

10446 EFFECT OF NEUTRON IRRADIATION DAMAGE ON THE LOW TEMPERATURE MECHANICAL PROPERTIES OF IRON AND ITS DEPENDENCE OF INTERSTITIAL IMPURITIES. Diehl, J.; Merbold, U.; Reimold, O.; Weller, M. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Nucl. Met., Met. Soc. AIME; 18: 69-80(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Examination of the influence of interstitial impurity atoms on radiation hardening and related phenomena indicates that the nature of the defects, which can contribute to the impedance of dislocation motion, depends strongly on impurity concentration and neutron dose. Relatively simple conditions seem to be present only if the impurity concentration is below the limit of solubility at the irradiation temperature and/or the neutron dose is relatively high. It appears that under these conditions thermally rather stable, small and well defined (narrow annealing interval) complexes determine the yield stress. From crystals with carbon impurity, it was concluded (1) that these complexes can be overcome by the dislocations by means of stress-aided thermal activation. In crystals with nitrogen being predominant, there are indications, that these complexes cause effects which are similar to alloy softening in very dilute bcc alloys. The other extreme case seems to occur if the impurity content is well above the solubility and the

neutron dose is not too high. Under such conditions radiation hardening might be caused primarily by radiation-induced precipitates, which most likely will be large enough to contribute primarily to the athermal component of the yield stress. It is concluded that under conditions in between these two cases, quite a large spectrum of more or less stable aggregates between lattice defects and impurity atoms can be present and interact with the moving dislocation. If this view is correct, controversies on irradiation hardening in iron could be explained by variations in the experimental parameters of different authors. (auth)

10447 ANNEALING OUT OF NEUTRON PRODUCED DEFECTS AS A RESULT OF LOW TEMPERATURE IRRADIATIONS. Okuda, S. (Japan Atomic Energy Research Inst., Ibaraki). Nucl. Met., Met. Soc. AIME; 18: 81-107(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

The recovery structure of bcc metals has long been considered by analogy with that of fcc metals. Recent experiments revealed, however, a complicated nature of the stage I recovery of bcc metals. These include the structure of substages, effect of impurities and effect of radiation or quench doping on the stage I recovery. A critical study of the stage I defects could be made by use of internal friction technique, the relaxation peaks due to the stress induced ordering and the dislocation pinning by these defects. For stage III, a similar problem as in fcc metals with a more complication by impurity effect is present. The temperature range of stage III of some bcc metals are also equivocal. These points are critically reviewed and discussed with emphasis on the recent experimental results obtained in our laboratory. (21 figures, 46 references) (auth)

10448 CRITICAL TESTING OF RECOVERY MODELS FOR MOLYBDENUM FOLLOWING PLASTIC DEFORMATION AND IRRADIATION ABOVE ROOM TEMPERATURE. Nihoul, J.; Stals, L.; Cornelis, J.; De Meester, P. (SCK/CEN, Mol, Belg.). Nucl. Met., Met. Soc. AIME; 18: 108-126(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

An analysis was made of published resistometric data on the recovery stages III and IV of Mo, completed with new results on the influence of various cold-work defect populations on the recovery kinetics of stages III and IV following neutron irradiation. The compatibility of these data with the interstitial model and with some variants of the vacancy model for stage III was investigated. It is shown that only the interstitial model, implying migration of interstitials in stages III and of vacancies or divacancies in stage IV, is compatible with all experimental data. Furthermore, the influence of various populations of cold-work defect structures on the defect production during neutron irradiation of molybdenum at 330°K and on the annealing spectrum up to 1200°K was investigated. It is shown that the presence of dislocations considerably enhances the defect retention. Cold-work stage III defects reduce this defect retention though stage III itself increases with respect to the cold work stage III. (7 figures, 29 references, 3 tables) (auth)

10449 RADIATION HARDENING AND RADIATION-ANNEAL HARDENING IN VANADIUM–OXYGEN ALLOYS. Wechsler, M. S.; Alexander, D. G.; Bajaj, R.; Carlson, O. N. (Ames Lab., IA). Nucl. Met., Met. Soc. AIME; 18: 127-146(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Tensile tests were performed on high-purity V containing 60 to 3160 weight ppM oxygen. Polycrystalline specimens were irradiated to 1.2×10^{19} neutrons/cm^2 (E > 1 MeV) at 105°C and to 1.5×10^{19} neutrons/cm^2 at 85°C. Two types of investigations were conducted: (1) a study of radiation-anneal hardening (RAH) in which the additional hardening upon post-irradiation annealing between 100 and 800°C was observed, as well as the recovery to pre-irradiation properties, and (2) the effect of irradiation on the temperature dependence of yielding in unirradiated, as-irradiated, and radiation-annealed specimens. The RAH (yield stress increase) occurs over the annealing temperature range of 100 to 400°C, and appears to increase in magnitude with increasing oxygen concentration. Recovery to pre-irradiation yield stress values takes place at 500 to 700°C. The mechanism proposed is that interstitial oxygen migrates to radiation-produced defect clusters, thus strengthening them as barriers to slip dislocation motion. The temperature dependence of the yield stress was observed over the range of test temperatures from 4 to 400°K. Radiation hardening increased with increasing oxygen concentrations for tests at 195-400°K. This was interpreted tentatively in terms of the formation of stronger dispersed barriers for higher oxygen alloys due to some trapping of oxygen at defect clusters during irradiation. At 4 and 77°K, where twinning occurs, the radiation hardening diminished with increasing oxygen concentration. Radiation softening did not occur, when analyzed in terms of the total yield stress. (44 referenecs, 10 figures) (auth)

10450 ANNEAL HARDENING IN NEUTRON IRRADIATED VANADIUM ALLOYS. Hasson, D. F. (Washington Technical Inst., DC). Nucl. Met., Met. Soc. AIME; 18: 147-162(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Postirradiation annealing investigations of the yield stress and internal friction were performed on neutron-irradiated vanadium–interstitial alloys. A brief anneal study of a neutron-irradiated vanadium–titanium alloy was also performed. Radiation anneal hardening was observed in all vanadium–interstitial alloys but did not occur in the vanadium–titanium alloy, which does not possess random interstitials. Radiation anneal hardening varied with impurity interstitial concentration up to about 300 at. ppM where the migrating interstitials saturate the defect loops. Beyond this saturation concentration, radiation anneal hardening is independent of impurity concentration up to a concentration of about 1450 at. ppM. For concentrations greater than 1450 at. ppM radiation anneal hardening again becomes a function of impurity concentration. These results agreed with an anneal calculation and correlated with the internal friction results. Radiation anneal hardening in vanadium was attributed, therefore, to the strengthening of radiation produced defect clusters by migrating impurity interstitials (mainly carbon and oxygen). (5 figures, 24 references) (auth)

10451 EFFECT OF NEUTRON IRRADIATION ON THE HIGH-TEMPERATURE MECHANICAL PROPERTIES OF VANADIUM–TITANIUM ALLOYS. Boehm, H. (Kernforschungszentrum, Karlsruhe, GE). Nucl. Met., Met. Soc. AIME; 18: 163-175(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Studies carried out at Argonne and Karlsruhe are reviewed. The effects of Ti content up to 20 wt % and temperature were studied; yield strength, creep, rupture strength, and microstructure are included. Results indicate a fast recovery from radiation damage above 650°C. (8 figures, 22 references). (auth)

10452 TENSILE PROPERTIES OF FAST REACTOR NEUTRON IRRADIATED bcc METALS AND ALLOYS. Wiffen, F. W. (Oak Ridge National Lab., TN). Nucl. Met., Met. Soc. AIME; 18: 176-197(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Rod tensile samples of Nb, Mo, Ta, one alloy based on each of these metals, and two V-base alloys were irradiated in EBR-II at temperatures between 390 and 1140°C to neutron fluences in the range 1.5 to 6.1×10^{22} neutrons/cm^2 (>0.1 MeV). The effect on the strength and ductility properties was determined in tensile tests at temperatures between 20 and 800°C at strain rates of 0.02 min^{-1} or slower. The effect of irradiation is most severe in Mo-base systems. Irradiation near 400°C renders Mo–50% Re brittle to at least 800°C. Similar irradiation of molybdenum and Mo–0.5% Ti produces a high concentration of small dislocation loops in the microstructure and raises the strain-rate dependent tensile DBTT from below room temperature to the range 400 to 550°C. Brittle failures occur with a mixed cleavage and grain boundary separation fracture mode. Specimens of Ta, T-111, and Nb–1% Zr exhibited zero uniform elongation but had total elongations in the range 4 to 10% with ductile mode fractures for most test conditions. Nb, V–10% Cr, and VANSTAR-7 had 5 to 17% total elongation and uniform elongations in the range 1.5 to 10%. Marked strength increases over control values were found in all samples. Results are discussed in terms of the microstructures and fracture modes. It is concluded that dislocation channeling is the process responsible for the complete loss of uniform elongation where loop hardening predominates. (12 figures, 5 tables) (auth)

10453 INFLUENCE OF IRRADIATION TEMPERATURE ON THE HARDENING BEHAVIOR OF THE REFRACTORY bcc METALS AND ALLOYS. Moteff, J.; Michel, D. J.; Sikka, V. K. (Univ. of Cincinnati). Nucl. Met., Met. Soc. AIME; 18: 198-215 (1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Mo, Nb, and one dilute alloy of these two metals (Mo–0.5 Ti and Nb–1 Zr), irradiated in EBR-II to fast neutron fluences equal or greater than 10^{22} n cm^{-2} at several elevated temperatures ranging up to 1000°C, are discussed. The irradiation-induced hardening at room temperature is attributed to the presence of

(1) small dislocation loops and black spot clusters, (2) large loops and dislocation networks, and (3) voids. All three classes of defects are believed to contribute to the hardening at the lower irradiation temperatures and only the voids at irradiation temperatures of about 0.35 T_m or greater. Calculations based on equations of the type $\Delta H = 6\alpha\mu b(Nb)^{\frac{1}{3}}$ are compared with experimental data where ΔH is the irradiation induced hardness increment, μ the shear modulus, b the Burgers vector with N and d being the defect density and defect diameter, respectively. The equation $\Delta H = 6\alpha\mu b(\rho)^{\frac{1}{2}}$ was used for the contribution due to dislocations of density ρ. The constant α was assumed to be equal to unity for the case of voids and 0.5 for the case of black spots, small loops, and dislocations. (auth)

10454 FIELD ION MICROSCOPE STUDY OF THE POINT DEFECT STRUCTURE OF A DEPLETED ZONE IN ION (W^+) IRRADIATED TUNGSTEN. Wilson, K. L.; Seidman, D. N. (Cornell Univ., Ithaca, NY). Nucl. Met., Met. Soc. AIME; 18: 216-239 (1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

A high purity zone-refined tungsten specimen irradiated in-situ under high vacuum conditions ($<5 \times 10^{-7}$ torr) at 473°K with 20-keV W^+ ions to a dose of $\simeq 9 \times 10^{11}$ W^+ ion cm^{-2} was used. The irradiated specimen was examined at 25°K by the pulse field evaporation technique and a total of 2.0×10^3 35-mm cine frames were recorded and analyzed in the reconstruction of the depleted zone. The depleted zone was found to consist of 41 vacant lattice sites clustered in a cubic region of approximately 13Å on a side. No contrast effects which could be attributed to self-interstitial atoms were found in or near the depleted zone or in the lattice surrounding it. If only first nearest-neighbor vacant lattice sites are considered, then the distribution of cluster sizes is as follows: (1) three monovacancies; (2) one divacancy; (3) one trivacancy; (4) one six-vacancy cluster; and (5) one huge cluster of 27 vacancies. It was shown that this depleted zone was created by a single incident ion, and a comparison of the measured number of vacant lattice sites with the value predicted by the Kinchin–Pease model showed directly that this model overestimates the number of displacements created per incident ion by a factor of approximately five in this case (irradiation temperature of 473°K). A diffusion model is also presented which explains the temperature dependence of the size of a depleted zone in terms of the mean range of a focused collision replacement sequence at a given irradiation temperature. (8 figures, 35 references) (auth)

10455 HELIUM-ION IRRADIATION OF VANADIUM AND NIOBIUM. Das, S. K.; Kaminsky, M. (Argonne National Lab., IL). Nucl. Met., Met. Soc. AIME; 18: 240-254(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

The helium bubble and blister formation in V and Nb by 0.5-MeV helium ion irradiation was investigated for doses ranging from 6.2×10^{16} to 6.2×10^{18} ions/cm^2 and for different target temperatures. The average blister size observed in polycrystalline samples irradiated at room temperature is smaller for the 40% cold-worked V samples than for the annealed ones. This difference in blister size is less pronounced for irradiation at 900°C. The blisters formed on the (111) surface plane of vanadium monocrystals by irradiation at 650–750°C with channeled $^4He^+$ ions exhibit distinct crystallographic features similar to those reported earlier for (111) niobium monocrystals. These features can be understood on the basis of certain active slip planes intersecting the (111) surface plane during blister formation. The effects of irradiation temperature on the mechanism of blister formation are discussed. (6 figures) (auth)

10456 HELIUM RE-EMISSION AND SURFACE DEFORMATION IN NIOBIUM, VANADIUM, AND MOLYBDENUM. Bauer, W. (Univ. of California, Livermore); Thomas, G. J. Nucl. Met., Met. Soc. AIME; 18: 255-278(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Helium re-emission was measured in Nb, V, and Mo during implantation to doses of 4×10^{18} He atoms/cm^2 at 400 to 1200°C. The resultant surface deformation was observed by scanning electron microscopy, and bulk defects within the implanted layer were observed by transmission microscopy. In general, the He re-emission is low until a critical dose is reached, at which time the re-emission abruptly rises to higher values. Both the critical dose and the re-emission at higher doses are strongly temperature dependent. In addition, the nature of the surface deformation, gas bubble morphology, and defect cluster formation is also strongly temperature dependent. (9 figures) (auth)

10457 CHARACTERIZATION AND BEHAVIOR OF ATOMIC HELIUM IN NIOBIUM. Johnson, D. L.; Cost, J. R. (Purdue Univ., Lafayette, IN). Nucl. Met., Met. Soc. AIME; 18: 279-301 (1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

High-purity Nb foil and wire were cyclotron injected with 0-46 MeV alpha particles to produce homogeneous helium concentrations of roughly 100 ppM. Lattice parameter measurements on an isochronally annealed irradiated specimen indicate that the as-injected helium is present substitutionally, probably as a helium–vacancy complex. A 180 ppM increase in the lattice parameter is found to occur with annealing near 200°C and is interpreted as being due to an initial stage in the precipitation of helium, but not the actual formation of bubbles. Measurements of helium loss to the surface of a foil specimen during isochronal annealing indicate that helium release occurs rapidly above 1000°C and continues to a maximum temperature above 1400°C until nearly all of the helium is released. The small fraction (<5%) of the injected helium which was not released was found by transmission electron microscopy to be present as bubbles with an average radius of 15 Å; these were first observed at 1000°C. Anneals from 1000 to 2150°C for various times did not appear to change the bubble size or density ($\sim 10^{14}$ per cm^3). Results are interpreted in terms of the competitive processes of precipitation to form helium bubbles and the migration of point defect clusters involving helium to cause gas release. Comparisons of the behavior of helium in Nb are made with previous results in Al and Cu. (6 figures, 27 references) (auth)

10458 CHARGED-PARTICLE SIMULATION STUDIES OF VANADIUM AND VANADIUM ALLOYS. Santhanam, A. T.; Taylor, A.; Harkness, S. D. (Argonne National Lab., IL). Nucl. Met., Met. Soc. AIME; 18: 302-320(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

The void-formation characteristics of V were studied using ion simulation techniques. Commercial-purity V with 1220 ppM C + N + O and high-purity vanadium with 145 ppM C + N + O were preinjected with 10 ppM helium and were irradiated between 650 and 850°C with 3.25 Ni^+ ions to a dose of ~60 dpa. The damage structure in high-purity V consisted of cubic voids at all temperatures, strain effects around voids at 650°C, and clusters of precipitates on or around voids at 700°C. In commercial-purity V, cubic voids were observed above 700°C, strain effects at 650 and 700°C, and precipitates on voids at 750°C. Peak swelling occurred at the same temperatures at which precipitates were observed. Samples that contained higher helium content (~100 ppM) showed drastically reduced swelling at 750°C, whereas the void volume was unaffected at 650°C. In a parallel study, tensile specimens of V–15 wt % Cr–5 wt % Ti were injected with 44-MeV alpha particles at the ANL Cyclotron to a dose of ~25 ppM helium and tested at temperatures between 700 and 900°C. When compared with control samples, the helium-injected specimens suffer an increasing loss of ductility with increasing test temperatures above 700°C. Examination of the test samples using optical and scanning electron microscopy indicates a change in fracture mode in the helium-injected samples. (10 figures) (auth)

10459 MICROSTRUCTURE OF ION BOMBARDED SINGLE CRYSTAL MOLYBDENUM. Brimhall, J. L.; Simonen, E. P. (Battelle Pacific Northwest Labs., Richland, WA). Nucl. Met., Met. Soc. AIME; 18: 321-331(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

The microstructure produced by bombardment with 7.5-MeV Ta^{3+} ions was studied in zone-refined single crystals of Mo at 900°C. Results on polycrystalline Mo are also presented. The void concentration reaches a maximum at a relatively low ion dose and further volume changes occur solely by void growth. The resultant void volume swelling shows a less than linear dependence on dose. No indication of swelling saturation is present up to a total dose of 150 dpa. The trend in the data is at least consistent with the approximate swelling formula of Brailsford and Bullough. The void lattice is well established at a relatively low dose of 10 dpa and increasing dose only produces increased perfection of the lattice. The lattice spacing does not vary with dose. An explanation for the void lattice based on an anisotropy of the vacancy concentration field is suggested. (7 figures) (auth)

10460 EFFECT OF OXYGEN IMPURITY ON VOID FORMATION IN ION BOMBARDED NIOBIUM. Loomis, B. A.; Taylor, A. T.; Klippert, T. E.; Gerber, S. B. (Argonne National Lab., IL). Nucl. Met., Met. Soc. AIME; 18: 332-340(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Niobium specimens containing oxygen concentrations between 10 and 900 ppM were irradiated at 500 to 1000°C with 3-MeV $^{58}Ni^{+}$ to 50 dpa. From transmission electron microscopy observations, the effect of oxygen impurity on void size and their number density was determined. Results were used to show that the void swelling of niobium at 800 to 1000°C is reduced approximately 50% for oxygen concentrations greater than 100 ppM. Alternative mechanisms of vacancy or self-interstitial trapping by oxygen atoms are proposed for the reduction in void swelling by oxygen impurity. This interpretation is preliminary since only the void arrangement was studied. (7 figures) (auth)

10461 EFFECT OF ALLOY ADDITIONS ON VOID NUCLEATION AND GROWTH. Smidt, F. A. Jr.; Sprague, J. A., Westmoreland, J. E.; Malmberg, P. R. (Naval Research Lab., Washington, DC). Nucl. Met., Met. Soc. AIME; 18: 341-362(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

The microstructures produced in iron and dilute iron alloys by neutron irradiation and heavy ion bombardment were studied by transmission electron microscopy. Solute additions are found to influence the temperature at which a given type of microstructure develops, specifically 0.3 at.% copper reduced the temperature at which voids formed in ion bombarded samples by 200°C and 0.3 at.% vanadium completely suppressed void nucleation. A model for vacancy trapping was formulated to determine the trends which might be produced by point defect trapping. It was concluded that the free vacancy concentration can be reduced by trapping which in turn can reduce the void nucleation to negligible rates. A correlation between reduction in swelling in dilute solid solution alloy systems and the presence of oversize solute atoms was noted. (7 figures) (auth)

10462 PROTON SIMULATION OF A FUSION REACTOR NEUTRON ENVIRONMENT. Logan, C. M.; Anderson, J. D. (Univ. of California, Livermore). Nucl. Met., Met. Soc. AIME; 18: 383-393(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

The neutron spectrum expected at the first wall of a fusion reactor is very different from that encountered in fission reactors, and little is known about its effects on bcc metals. In order to simulate this spectrum, the incident particle must induce in bulk metal samples recoiling atoms with energies like those created by the neutron flux. Investigation shows that 16-MeV protons simulate very closely the energy spectrum of primary recoiling atoms expected in a D-T fusion reactor. Low-fluence irradiations of copper with 16-MeV protons and 14-MeV neutrons have produced damaged samples with identical cluster size distribution. (auth)

10463 TERMINATION OF VOID GROWTH IN IRRADIATED MATERIALS. Brailsford, A. D.; Bullough, R. (Atomic Energy Research Establishment, Harwell, Eng.). Nucl. Met., Met. Soc. AIME; 18: 493-508(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Some of the factors that determine the high-temperature high irradiation dose behavior of materials containing growing voids are examined and discussed. The relevant high-temperature parameters are gas generation rate, deformation dislocation density, applied stress, surface energy, and grain size. The dominant saturation process in the dependence of swelling against dose at the peak swelling temperature is considered to arise from the "induced" interactions between the irradiation produced dislocations and the voids. (auth)

10464 VOID COALESCENCE AND GROWTH IN METALS UNDER IRRADIATION. Mansur, L. K. (Cornell Univ., Ithaca, New York); Okamoto, P. R.; Taylor, A.; Li, C. Y. Nucl. Met., Met. Soc. AIME; 18: 509-529(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

A method for calculating irradiation-induced swelling is proposed which includes the effects of void coalescence and the possibility that void growth is controlled by surface reactions. Void coalescence is assumed to result from mutual impingement due to growth. Results are discussed in terms of existing experimental data. Suggestions are made for possible approaches for swelling data extrapolation. (9 figures) (auth)

10465 EFFECTS OF INSOLUBLE GASES ON NUCLEATION OF VOIDS DURING ENERGETIC PARTICLE IRRADIATION. Wiedersich, H. (Argonne National Lab., IL); Katz, J. L. Nucl. Met., Met. Soc. AIME; 18: 530-544(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

The influence of immobile, insoluble gas atoms, and gas-atom clusters on the nucleation rate of voids during irradiation with energetic particles is evaluated by a parallel-path method with Ni as the sample material. As expected, the presence of gas aids the nucleation of voids. The effect is most pronounced at higher temperatures and at lower defect supersaturations. The presence of large gas clusters appears to be a prerequisite for copious void nucleation in the upper portion of the temperature range encountered in fast-breeder reactors. As the temperature decreases, the defect supersaturations for a given defect production rate increase markedly. This causes nucleation on smaller gas clusters, single gas atoms, and also homogeneous nucleation to become the dominant nucleation mechanism as the temperature decreases. (auth)

10466 EFFECTS OF IMPURITY ATOMS ON VOID NUCLEATION. Russell, K. C.; Hall, D. H. (Massachusetts Inst. of Tech., Cambridge). Nucl. Met., Met. Soc. AIME; 18: 545-564(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

The effects of dissolved gaseous and nongaseous impurities on void nucleation in irradiated metals are considered. The difference equation applicable to the phenomenon is evaluated by time difference solution; numerical results are presented for several cases. Analytical expressions derived previously for cases of very high or very low impurity mobility are discussed, and calculations are presented. For nongaseous atoms, an approximately 0.3 eV impurity–void binding energy is the threshold for catalytic effects. Highly mobile impurities with larger binding energies may increase void nucleation rates by many orders of magnitude. Concentrations of inert gases in the ppM range may enhance void nucleation if the heat of solution of +0.7 eV or greater. Slightly larger heats of solution may give very marked increases in the void nucleation rate. Combined effects of several impurities are also possible. (9 figures, 27 references) (auth)

10467 COMPUTER EXPERIMENTS ON DEFECT ANNEALING IN ALPHA–IRON. Beeler, J. R. Jr.; Beeler, M. F. (North Carolina State Univ., Raleigh). Nucl. Met., Met. Soc. AIME; 18: 581-603(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

Computer experiment methods were used to simulate defect production and annealing in alpha–iron by electron, heavy ion, and neutron irradiation. In each instance, the spatial distribution of defects has been described in detail at the atomic level. Both annealing during irradiation and post-irradiation annealing have been treated. In order to maintain continuity with the early work of Erginsoy et al. and of Johnson, on alpha–iron, the Erginsoy–Vineyard–Johnson potential function has been used exclusively in both the defect production and defect annealing computer experiments. Strain field interactions among defects were considered explicitly in computing the defect jump rates and jump directions. Both homogeneous and heterogeneous nucleation of defect aggregates were considered. In this regard, the heterogeneous nucleation centers treated include impurity atoms, precipitates, dislocations, grain boundaries, and free surfaces. Exploratory work on the effect of precipitate, void and bubble resolution was performed as well. (9 figures) (auth)

10468 EMBRITTLEMENT OF LOW-ALLOYED STEELS CAUSED BY NEUTRON IRRADIATION IN WATER AT TEMPERATURES BELOW 100°C. Alekseenko, N. N.; Nikolaev, V. A. Sov. J. At. Energy (Engl. Transl.); 34: No. 1, 40-41(Jan 1973).

Translated from At. Energ. (USSR); 34: No. 1, 32-33(Jan 1973).

The intensive embrittlement of low-alloyed steels irradiated in water is caused by saturation with the hydrogen evolving as a result of steel corrosion and water radiolysis. The absence of embrittlement under corrosion conditions in irradiation with doses smaller than the threshold dose indicates that the dominant factor in this phenomenon is the density of radiation defects in steel and not the hydrogen penetration. It can also be assumed that hydrogen in irradiated steel interacts with the radiation defects and is retained by them. (auth)

10469 INFLUENCE OF AN ELASTIC FIELD OF A DISLOCATION ON STEADY-STATE DIFFUSION FLUXES OF POINT DEFECTS. Margvelashvili, I.G.; Saralidze, Z.K. (Institute of Physics, Academy of Sciences of the Georgian SSR, Tbilisi). Sov. Phys.-Solid State 15: No. 9, 1774-1776 (Mar 1974).

A study is made of the influence of the elastic interaction between point defects and a dislocation on the steady-state diffusion fluxes of these defects. In the isotropic approximation this interaction increases the total flux of point defects reaching a unit length of the dislocation. Generalization of this result to the case of anisotropic crystals makes it possible to explain qualitatively the phenomenon of weak radiation growth, which accompanies swelling due to the evolution of a gas in anisotropic α uranium. (auth)

10470 HIGH BURNUP IN URANIUM CERMET ALLOYS. Voloshchuk, A. L.; Votinova, V. V.; Golovchenko, Yu. M.; Zavgorodnii, A. Ya.; Zelenskii, V. F.; Konotop, Yu. F.; Timchenko, R. A. Sov. J. At. Energy (Engl. Transl.); 34: No. 4, 355(Apr 1973).

Translated from At. Energ. (USSR); 34: No. 4, 286-287(Apr 1973).

Radiation effects on BeO-hardened U alloys are described. Information and data are also included on irradiation in SM-2 reactor of binary U alloys containing Mo, Al, Fe, or Si. (JRD)

10471 ALIGNMENT OF DISLOCATION LOOPS IN IRRADIATED METALS. Stiegler, J. O.; Farrell, K. (Oak Ridge National Lab., TN). Scr. Met.; 8: No. 6, 651-655(Jun 1974).

Three-dimensional arrays of loops were found in neutron-irradiated Ni and Al in the presence of voids. Stereo microscopy was used. Results indicate that damage is accumulated more efficiently by neutron irradiation than by ion bombardment. (DLC)

10472 INTRINSIC STAGE-III ANNEALING IN NIOBIUM AND TANTALUM FOLLOWING ELECTRON IRRADIATION. Faber, K.; Schweikhardt, J.; Schultz, H. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Scr. Met.; 8: No. 6, 713-720(Jun 1974).

High-purity Nb and Ta foils were irradiated with 3-MeV electrons at 4.5°K and isochronal and isothermal annealing treatments were carried out between 5 and 600°K. The annealing stages were classified. Stage-III annealing in Nb occurs at 220–280°K and in Ta at 260–300°K. (35 references). (DLC)

10473 RECOVERY PHENOMENA IN FCC METALS FOLLOWING ONE-DIRECTIONAL AND CYCLIC DEFORMATION. Bischoff, A. Stuttgart; Univ. Stuttgart (1973). 103p. (In German).

Thesis.

The thermal recovery behavior of the lattice defects, created by one-directional deformation and fatigue, was investigated for fcc metals, especially for copper. In order to be able to discuss more closely the point defects in alternately stressed materials, the process after one-directional stressing should firstly be explained, and the changes resulting from the transition to the alternating stressing should be shown. Measurements of the E-module and the thermal resistance were used as method of investigation and several ways of creating defects (irradiation and quenching experiments, dosing the sample with oxygen or hydrogen) were used. Besides a thorough investigation of copper, a few additional module measurements on silver and nickel were done. (GE)

10474 SIGN DETERMINATION OF eqQ FOR ^{12}B IMPLANTED IN TANTALUM. Hori, M.; Ochi, S.; Minamisono, T.; Mizobuchi, A.; Sugimoto, K. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap., Suppl.; 34: 161-163(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Other Materials

Refer also to abstracts 9051, 9445, 10264, 10883, 10884, 11861, and 11970.

10475 (GEPP-115) EFFECTS OF TOLUENE AND POLYSULFIDE ON SEMIRIGID INSPECTION RESIN. Creed, K. E. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). [nd]. Contract AT(29-2)-656. 11p. Dep. NTIS $4.00.

Semirigid inspection resin (SRIR) is used to encapsulate a component of a neutron generator manufactured at General Electric Neutron Devices Department. To ensure stress relief in the casting after further processing, a release or cushion coating is often applied. It was found that several coatings had induced undesirable softening of the SRIR and toluene appeared to be an ingredient common to the coatings. This study evaluated the effect on SRIR of toluene and a polysulfide containing toluene. Both induced softening. Test specimens with the polysulfide rubber showed a significant reduction of tensile strength. The studies showed that protection could be achieved by use of a zinc undercoat. (auth)

10476 (GEPP-123) SOLDER FLUX RESIDUE CLEANING. Creed, K. E. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). [nd]. Contract AT(29-2)-656. 18p. Dep. NTIS $4.00.

When coil windings such as transformers and inductors are encapsulated in resin, care must be taken that good castings are achieved. Shear planes, voids, cracks, and delaminations in the casting provide structural weaknesses that may contribute to electrical breakdowns. Defect analysis of cast assemblies at GEND showed that the cracks, voids, and delaminations were often associated with solder flux residues. Solution of the problem was achieved by removal of the solder flux residue using ultrasonic cleaning in Freon-isopropanol prior to casting. However, because the wire enamel is soluble in the solvent, with subsequent deposition on the part, further investigation of enamel solubilities in a variety of solvents was carried out. Results showed that heptane offers the best compromise of low solubility, good resin removal and evaporation rate. (auth)

10477 (JAPFNR-152) RADIATION RESISTANCE OF SOME HYDRAULIC FLUIDS FOR SHOCK ABSORBERS. Tokunaga, O.; Abe, T.; Kageyama, E. (Japan Atomic Energy Research Inst., Tokyo). Jul 1972. 49p. (PNC-J-250-72-20). Dep. NTIS (US Sales Only) $5.50.

For Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan).

In order to select the radiation-resistant hydraulic fluids suitable for the shock absorbers to be used in fast breeder reactors, 19 kinds of organic fluids were irradiated with γ-rays from ^{60}Co sources up to the dose of 3×10^9 R at room temperature. The amount and composition of the evolved gas were measured and the physical properties of the irradiated fluids were examined. As for the evolution of gas, fluids of higher aromatic content were observed to be more resistant to radiation. Within the scope of this work, the two kinds of fluids, a substituted polynuclear aromatic hydrocarbon oil and a silicone oil of high phenyl content, 1, 2, 3-trimethyl-1, 1, 2, 3, 3-pentaphenyltrisilioxane, were found to be suitable for the above purpose because of the small gas evolution as well as the little changes in physical properties induced by radiation. (auth)

10478 (LA-5535-C, pp 296-330) PION CHANNELING IN CRYSTALS. Gemmell, D. S. (Argonne National Lab., IL). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

A brief review is given of charged particle channeling in crystals. Details are presented for planned experiments in which positive and negative pions will be used as the incident particles. These experiments are expected to prove useful in relating the different theoretical descriptions applicable to positive and negative ion channeling. Although the π^- beam is expected to be about a factor of 4 less intense than the π^+ beam, the two beams will be selectable with identical energies, emittances, etc. This will permit comparisons to be made between channeling effects for particles identical except for sign of the charge. There is also the possibility of using channeling to explain the differences in the stopping cross sections for positive and negative pions. (SFL)

10479 EFFECT OF GAMMA-IRRADIATION ON CATION EXCHANGE RESIN. Ichikawa, T.; Hagiwara, Z. (Tohoku Univ., Sendai). J. Nucl. Sci. Technol. (Tokyo); 10: No. 12, 746-752 (Dec 1973).

Several forms of cation exchange resins with different crosslinkages have been subjected to ^{60}Co γ-radiation, in wet or dry state and the effects of such variables as adsorbed ionic species, crosslinkage of the resin, and the water content in the resin on radiation damage to organic resin have been examined in their relation to γ-radiation dose. The result showed that radiation caused marked changes in the chemical and physical properties of the resin, and phenomena such as de-crosslinking, loss of strong-acid capacity, formation of a functional group composed of a weak-acid exchange group were observed. The degree of such degradation phenomena was not affected by adsorbed ions when their valency states were kept unchanged during irradiation, but when the adsorbed ions were reduced during exposure, the extent of degradation was found inhibited to a significant extent. It may be concluded from the results that the decomposition of the cation exchange resin is mainly initiated by reaction with the resin produced by radiation-formed reducing species, i.e., H atoms. A mechanism of resin degradation is also proposed. (JA)

10480 ELECTRON SPIN RESONANCE AND OPTICAL STUDIES OF THE DOUBLE-HOLE V^0 CENTRE IN MgO. Kappers, L. A.; Dravnieks, F.; Wertz, J. E. (Univ. of Minnesota, Minneapolis). J. Phys., C (London); 7: No. 7, 1387-1399(7 Apr 1974).

Isolated cation vacancies are created by neutron irradiation of MgO crystals maintained at ~32°C; these vacancies trap one posi-

tive hole to form stable V^- centres ($Mg\ O^+$ [=] O Mg). Subsequent x-irradiation at 77°K causes some V^- centres to trap an additional hole to form V^0 centres ($Mg\ O^+$ [=] O^- Mg). In these representations, only derivations from normal site charge are shown. Independently, some unstable V_M centres ($Mg\ O^+$ [=] O M^+) are formed. Here M^+ represents a substitutional trivalent ion. ESR spectra of V^- and V_M centres are indistinguishable at 77°K; however, at room temperature, the V^- centres give an isotropic line which permits the unambiguous determination of their number. Decay of V^0 and V_M centres at room temperature regenerates the number of V^- centres originally present before x-irradiation. Analysis of the optical absorption of V^0 centres shows that at 77°K their absorption band in MgO is centred at 2.37 eV and has a half-width of 0.95 eV. Measurements of the oscillator strength of the V^0 centre give f = 0.24, approximately 1.7 times that of the V^- centre. (auth)

10481 DYNAMIC PROPERTIES OF HIGH-MOBILITY GARNET FILMS IN THE PRESENCE OF IN-PLANE MAGNETIC FIELDS. Shaw, R.W.; Moody, J.W.; Sandfort, R.M. (Monsanto Company, St. Louis, Missouri 63166). J. Appl. Phys. 45: No. 6, 2672-2677 (June 1974).

The dynamics of domain wall motion in $Gd_xY_{3-x}Ga_yFe_{5-y}O_{12}$ garnet films has been studied using optical response to a fast-rise pulse in bias field. Damped oscillations of the domain walls have been observed and analyzed to yield domain wall mass per unit area, mobility, and limiting velocities. Masses have been found which are in excess of the accepted theoretical values for thick samples by factors between 1.5 and 3.6. Limiting velocities have been determined in general agreement with values predicted by Slonczewski for motion involving generation and propagation of horizontal Bloch lines. The application of a magnetic field in the plane of the film and in the plane of the domain walls under observation caused a decrease in domain wall mass density and increases in mobility and limiting velocity. The mass decrease is substantially greater than that predicted by theory. (auth)

10482 OPTICAL ABSORPTION IN ION-BOMBARDED MAGNETIC GARNET FILMS. Seman, J.A.; Wemple, S.H.; North, J.C. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Appl. Phys. 45: No. 6, 2700-2704 (June 1974).

Optical absorption measurements are reported for the damaged surface layers produced by proton and neon bombardment of iron-garnet liquid-phase-epitaxial films. The excess optical absorption is shown to be an absorption tail on O(2p) →Fe(3d) charge-transfer bands centered near 4 eV with about 10% contributed by higher-energy optical transitions. The distribution of states for Ne bombardment is different from that for H bombardment, and in the case of Ne the state distribution depends on the dose. Saturation at a photon energy of 2.2 eV occurs at an absorption coefficient of $\sim 2\times10^4$ cm^{-1}. The average damage density over the damaged layer thickness is observed to increase with decreasing H energy, in agreement with hard-bubble-suppression data and nuclear stopping power considerations. Based on optical absorption and hard-bubble-suppression results it is estimated that the dose window for hard bubble suppression corresponds roughly to an average disorder range from ~3-30% amorphous (amorphous defined optically). Annealing studies show that no simple activation energy description applies to the damaged material. Deep states anneal out more rapidly than shallow states for both H and Ne bombardment. (auth)

10483 THE EFFECTS OF IONIZING RADIATION ON THE HARDENING OF KBr_xCl_{1-x}. Hopkins, J.R.; Martin, J.J. (Oklahoma State University, Physics Department, Stillwater, Oklahoma 74074); Larkin, J. J. Appl. Phys. 45: No. 6, 2804-2805 (June 1974).

The flow stress of a series of KBr-KCl mixed crystals has been measured as a function of radiation damage. The magnitude of the increase in flow stress is approximately the same as it is for pure KCl or KBr for equivalent amounts of damage. This result shows that the radiation hardening and alloy hardening are additive. The data have also been used to indicate the size and shape of the interstitial clusters in these mixed crystals. (auth)

10484 TETRAPHOSPHORIC RADICAL IN PHOSPHATE GLASSES. Yudin, D.M.; Shendrik, A.V.; Petrovskaya, M.L.; Nikolina, G.P. Sov. Phys.-Solid State 15: No. 9, 1754-1756 (Mar 1974).

ESR was used to study radiation centers generated by γ irradiation of 90 $Ba(PO_3)_2 \cdot 10BaF_2$ glasses. A tetraphosphorus-oxygen tetrahedra bound into a single ring was discovered. The interaction between the unpaired spin and the four P^{31} nuclei produced five hyperfine structure lines split by 30 Oe. The tetraphosphoric radical was observed in pure $Ba(PO_3)_2$ before its transition to the glassy state. The introduction of BaF_2 stabilized this radical in the glassy state. The results obtained should be regarded as the first experimental proof of the existence of a geometrical order extending beyond the short-range order in glasses. (auth)

10485 X-RAY DIFFRACTION DATA AND ENTHALPY OF FUSION FOR $Cs_2B_6O_{10}$. Marlor, A. J.; Bergeron, C. G.; Kumar, H. S. A. (Univ. of Illinois, Urbana). J. Amer. Ceram. Soc.; 57: No. 5, 233(May 1974).

D values and relative line intensities were obtained by a powder diffraction method. Interplanar spacings for a large number of planes calculated from Krogh-Moe's structure for $Cs_2B_6O_{10}$ were found to agree with those from powder diffraction. The fusion enthalpy was determined from quantitative DTA to be 34.9 ± 1.36 cal/g (17.2 ± 0.67 kcal/mol). (DLC)

10486 IMPUL'SNYI NAGREV IZLYCHENIYAMI. Chast' Pervaya. Kharakteristiki impul'snogo Oblycheniya i Luchistogo Nagreva. (Pulse Radiative Heating. Part I. Characteristics of Pulse Irradiation and Radiative Heating). Grigor'ev, B. A. Moscow; Izdatel'stvo Nauka (1974). 319p.

This book deals with the pulse heating of bodies by electromagnetic and corpuscular irradiation. Particular attention is devoted to heating plane bodies by optical radiation. The first part of the book reviews various radiative emitters, the basic geometrical, energy and time characteristics of pulse irradiation and radiative heating, and also the characteristics of the propagation and absorption of radiation. On the basis of these characteristics the space-time distributions of heat sources and their approximation by elementary, dimensionless functions are considered. The second part includes the statement and solution of heat conduction problems by the use of integral transformation in order to determine the nonstationary temperature fields of an infinite disk, semi-infinite and infinite bodies during pulse radiative heating. A summary of general and partial solutions is given in dimensionless form. Application of the solutions to engineering calculations is considered and error estimates in determining the temperature are given for various assumptions. Simplified methods of calculating nonstationary temperature fields are presented. (SJR)

10487 IMPUL'SNYI NAGREV IZLUCHENIYAMI. Chast' Vtoraya. Nestatsionarnye Temperaturnye Polya Pri Impul'snom Luchistom Nagreve. (Pulse Radiative Heating. Part II. Nonstationary Temperature Fields During Pulse Radiative Heating). Grigor'ev, B. A. Moscow; Izdatel'stvo Nauka (1974). 727p.

This second volume deals with the statement and solution (by means of integral Fourier transformations) of heat conduction problems in order to determine nonstationary and stationary fields of an infinite disk, of semi-infinite and infinite bodies during pulse radiative heating and an inhomogeneous, initial temperature field. The solutions are in dimensionless form for the general case and for the case where the initial temperature fields and space-time distributions of the internal heat source or of heat flux on the irradiated surface can be approximated by separable, coordinate and time functions. Consideration is given to a method of using general dimensionless solutions for engineering calculations, which includes ways of determining temperatures and error estimates, and the use of superposition and interpolation in calculating temperatures. A summary of dimensionless solution-integrals is given in terms of dimensionless time and dimensionless coordinates which correspond to the selection of the approximating functions. Various simplified and express methods are presented. (SJR)

10488 MEASUREMENT OF THERMAL CONDUCTIVITY OF CARBON FOAM AT TEMPERATURES BETWEEN 1,400 AND 1,900°K. Woener, B.; Neuer, G. Stuttgart; Univ. Stuttgart (1972). 34p. (In German). (IKE-5-114e).

Thesis.

A procedure of measuring the thermal conductivity of poor heat conductors is described. The use of two or more disc-like samples of different thickness offers the possibility to measure the temperature drops in layers of almost any thickness by means of a pyrometer. The one-dimensional heat flow (in the radially shielded samples heated by electron bombardment) can be determined from the radiation flux measured at the cold face of the sample by a total-radiation pyrometer. Descriptions are given of the measuring arrangement, including the technical requirements for measurements on carbon foam. A detailed error calculation is given, the results indicating that an inexactitude of measurements of 5 to 6% can be assumed. The measurements have been performed at temperatures between 1350 and 1,900°K on carbon foam of a density of 0.2 g/cm³, and a porosity of 90 vol %, respectively. (GE)

10489 EFFECT OF GAMMA RADIATION ON VARIOUS SYNTHETIC INORGANIC ION EXCHANGERS. Zsinka, L.; Szirtes, L.; Mink, J.; Kalman, A. (Magyar Tudomanyos Akademia Izotop Intezete, Budapest). J. Inorg. Nucl. Chem.; 36: No. 5, 1147-1152(May 1974).

The structure and some properties of crystalline zirconium and cerium phosphates and cerium arsenate ion exchangers after irradiation have been investigated. The absorbed dose was about 10^9 rad. No change in the structure of crystalline

zirconium phosphate was observed, while cerium arsenate showed changes both in the structure and other properties; cerium phosphate was destroyed during the irradiation. (auth)

10490 MECHANICAL PROPERTIES OF BORON FIBERS. Zhigach, A. F.; Tsirlin, A. M.; Shchetilina, E. A.; Svetlov, I. L.; Grigor'ev, V. I.; Shafranovich, E. G.; Bulygina, T. I.; Iartsev, V. A. (State Scientific Research Inst. of Chemistry and organic Technology, Moscow). Mekh. Polim.; 641-647(Aug 1973). (In Russian).

The strength distribution of a boron fiber subjected to tension, typical defects arising in the fiber, and the dependence of the mean strength on the fiber length are investigated. It is shown that the nature of the strength distribution of boron fibers in a general set can be established from histograms of the distribution in a large group of tests under constant conditions. It is established that the strength of a boron fiber can be described with an accuracy which is satisfactory for practical purposes by Weibull and normal distributions, and the parameters of these distributions are determined. Typical defects in the macrostructure of boron fibers are noted and described. An experimental study is made of the dependence of the mean strength of a boron fiber on the sample length, satisfactory agreement being noted with theoretical scale dependences deriving from the Weibull and normal distributions. (IAA)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstract 9093.

10491 (IAEA-R-967-F) DEVELOPMENT OF AN OPTICAL INSTRUMENT AND TECHNIQUE TO INDICATE TAMPERING WITH REACTOR FUEL ASSEMBLIES. Final Report, 1 January 1971–31 August 1972. Deichman, J.; Coleman, W. (International Atomic Energy Agency, Vienna (Austria)). Nov 1972. 40p. INIS.

Under a contract to develop an optical instrument and technique to indicate tampering with reactor fuel assemblies, an optical instrument was developed and manufactured for the IAEA. The instrument is intended for use in detecting signatures, minute surface markings or scratches on critical parts of fuel assemblies which occur during the course of manufacture, and to determine if fissionable material, which was originally packaged, might have been removed without authorization. To make this determination the instrument utilizes an optical comparison design, whereby two transparencies, one obtained shortly after the fuel bundle assembly has been fabricated and one at some later time, are optically compared for surface marks and scratch correlation. Four optical comparison modes, split-image, two-color, chopped-image and eye-to-eye are available to implement the optical correlation. In addition, a permanent record of the comparison image can be made with the instrument. An image resolution approaches 40 lines/mm providing the capability for high resolution of surface scratch and mark detail. (INIS)

10492 NUCLEAR MATERIAL CONTROL SYSTEMS FOR FUEL REPROCESSING FACILITIES (A GUIDE TO PRACTICE). New York; American National Standards Institute, Inc. (1974). 8p. (ANSI-N-15-13-1974).

This standard establishes guidelines for control of nuclear material in aqueous fuel reprocessing facilities. Such facilities are those which process irradiated fuel from nuclear reactors to recover various materials from the fuels, in particular, source and special nuclear materials. The processing involved could include mechanical and chemical treatments to effect the separation of materials to be recovered from the unwanted fission products and other fuel assembly components and materials, and conversion of the recovered materials to other forms such as oxides or hexafluorides. The nuclear materials of interest for the purposes of this standard are the recovered uranium and plutonium. The normally expected forms for these recovered products include uranium or plutonium nitrate solutions, uranium or plutonium oxides, or uranium hexafluoride. (auth)

Disposal and Storage

Refer also to abstracts 9526, 9565, and 11951.

10493 (BNWL-B-223) ADVANCED WASTE MANAGEMENT STUDIES. Progress Report, April–May 1972. Platt, A. M. (ed.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1972. Contract AT(45-1)-1830. 67p. Dep. NTIS $6.50.

Currently six major options are under study: sea, permanent ice, extraterrestrial, transmutation, deep cavities, and permanent engineered storage. Of these, sea, ice, extraterrestrial, and transmutation disposal would require additional separations of high-level waste into a fission product fraction and an actinide fraction. Also, these options do not appear useful for cladding and alpha wastes. Both sea or permanent ice disposal seem uncompetitive because of the uncertainty involved, the anticipated magnitude of the R & D program required, and the lack of clear cut advantages. Deep cavity studies indicate that either shale or domed salt deposits may be superior to hard rock. Similarly, definite advantages exist for a mined cavity rather than a nuclear produced cavity. (auth)

10494 (IEA-300) STUDIES FOR THE OCEAN DISPOSAL SYSTEM FOR SEWAGE IN SANTOS AND SAO VICENTE. Part 1. Occhipinti, A. G.; Sanchez, W.; Gaglianone, S. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Aug 1973. 39p. (In Portuguese). Dep. NTIS (US Sales Only) $5.00.

The plan of work and the preliminary results of oceanographic investigations for the implantation of the submarine outlet for sewers entering the ocean at the José Menino beach and extending in the direction of the Santos Bay entrance are described. The overall plan of the Santos and São Vicente sewer system fixed four possible points for the placement of the drain, based on theoretical and empirical studies. Because oceanographic and bacteriological investigations were indispensable for the project, a study group was established to study the pattern of bacteriological concentration in the waters near Itaipu Point and to measure currents and vertical water structure, the process of diffusion through oceanic mixing and physical dilution in the sewer and the efficiency of coloration. The results, although preliminary, permitted the anticipation of some conclusions and delimited the area where the investigation must be intensified. (auth)

10495 (IEA-301) STUDIES FOR THE OCEAN DISPOSAL SYSTEM FOR SEWAGE IN SANTOS AND SAO VICENTE–OCEAN MIXING. Part 2. Sanchez, W.; Garcia Agudo, E.; Leomax dos Santos, J.; Szulak, C.; Occhipinti, A. G. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Aug 1973. 43p. (In Portuguese). Dep. NTIS (US Sales Only) $5.25.

The objectives of this work were to determine the laws that govern the phenomena of dilution and turbulence diffusion of a radioactive substance, injected as a point source, instantaneously in Santos Bay, taking into account oceanographic conditions. While the radioactive "cloud" formed is carried out by the current and dispersed by the water turbulence, its configuration is modified. In each experience it was confirmed that the size of the radioactive tracer's cloud measured by its variance is related to the time interval elapsed since the injection. This relation is a function of the oceanographic conditions. The analysis of the experimental data was based on the diffusion theory proposed by OKUBO. (auth)

10496 (ORNL-TM-4467) SHALE FRACTURING INJECTIONS AT OAK RIDGE NATIONAL LABORATORY: 1972 SERIES. Weeren, H. O. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 98p. Dep. NTIS $8.00.

A series of four injections of intermediate level waste solution was made during the fall of 1972. A total of 301,520 gal of waste solution containing 100,200 Ci of radionuclides was injected. Prior to this series of injections a large volume of waste solution had been accumulated. The need to dispose of this accumulation of waste and to regain operating flexibility in the tank farm led to the scheduling of the injections as close together as practical (i.e., about three weeks apart). Several modifications to the shale fracturing facility are scheduled to be installed in 1973. Detailed information on the performance of the existing facility was needed for the design of the proposed modifications, and a particular effort was made to obtain these data from the 1972 injections. This report is an account of this injection series–preparations, injections, and results and conclusions. A summary of the volumes and activities that were injected is given. (auth)

10497 (PB-227873) RADIOACTIVE WASTE MANAGEMENT AT NUCLEAR FUEL REPROCESSING PLANTS. Paper No. 72-2. Franco, J. A.; Cady, K. B. (Cornell Univ., Ithaca, N. Y. (USA)). Feb 1972. 31p.

Light water reactor fuel reprocessing plants are a major source of fission product contamination of the environment. One commercial plant, West Valley, has a capacity of one metric tons of uranium per day (MTU/D) and plans to expand to three MTU/D. A second Purex process plant, the Midwest Fuel Reprocessing Plant, is scheduled to go into operation in 1972 with a capacity of one MTU/D. A third, using a hybrid Purex-fluoride volatility process, is the Barnwell plant scheduled for commercial operation in 1974. High-level radioactive waste disposal at each plant will conform to AEC requirements of solidification, but designation of federal repositories and ultimate storage-disposal is not yet decided upon. The two proposed plants, Barnwell and MFRP, plan to eliminate low-level liquid radwastes by evaporation and discharge as gaseous wastes. This has an advantage of not requiring a large natural body of water for dilution and results in wider dispersion of tritium in the biosphere. The West Valley low-level radwaste system was changed in 1971 to include flocculation, sedimentation, and ion-exchange additions which effectively reduce strontium and cesium liquid discharges. The augmented system has some effect on ruthenium, but does not reduce tritium discharges to Cattaraugus Creek. None of the three fuel reprocessing plant designs have noble gas removal systems. Site boundary doses from krypton-85 can be reduced by taller stacks or larger sites; however, global population doses can only be reduced by noble gas removal coupled with long term storage. Such removal systems are not now planned but may be required in the future. Iodine-131 and -129 dose rates to the population through the pasture-cow-milk thyroid pathway can and are being reduced by use of chemical filter systems. It is recommended that global population dose limits be established for krypton-85 from fuel reprocessing plants, and that long range tritium disposal, such as deep well storage, be investigated. (auth)

10498 RADIOACTIVE SUBSTANCES (HOSPITALS' WASTE) EXEMPTION (SCOTLAND) AMENDMENT ORDER 1974. Statutory Instruments 1974, No. 487. London; Her Majesty's Stationery Office (1974). 2p.

In the principal order for the words "Board of Management" there shall be substituted the words "Health Board". (text of amendment) (UK)

10499 RADIOACTIVE SUBSTANCES (HOSPITALS' WASTE) EXEMPTION (AMENDMENT) ORDER 1974. Statutory Instruments in 1974, No. 501. London; Her Majesty's Stationery Office (1974). 2p.

In the definition of "premises of a hospital" contained in article 2(1), for sub-paragraph (a) there shall be substituted the following: "(a) premises of a hospital with respect to the management and control whereof any functions are exercised by an Area Health Authority or a Board of Governors specified in an order made under Section 15 of the National Health Service Reorganization Act 1973" (text of amendment) (UK)

10500 WASTE MANAGEMENT FOR NUCLEAR POWER. West, P. J. Int. At. Energy Agency Bull.; 16: No. 1/2, 78-89 (1974).

Waste management as related to nuclear power includes the management of wastes during all stages of the fuel cycle, i.e., during the discovery and extraction of naturally occurring fissile material, fuel enrichment, fuel element fabrication, reactor operation, and reprocessing of spent fuels for re-use. The wastes produced at these various stages include waste heat, and solid, liquid, and gaseous radioactive wastes. The quantities of wastes produced and waste treatment and disposal methods are discussed. (LCL)

Handling Equipment and Procedures

Refer also to abstract 9089.

10501 (Y-1948) VALIDATION OF THE KENO CODE FOR NUCLEAR CRITICALITY SAFETY CALCULATIONS OF MODERATED, LOW-ENRICHED URANIUM SYSTEMS. Handley, G. R.; Hopper, C. M. (Oak Ridge Y-12 Plant, Tenn. (USA)). 13 Jun 1974. Contract W-7405-eng-26. 68p. Dep. NTIS $5.45.

The Monte Carlo computer code, KENO, was employed to calculate 40 critical experiments with uranium enrichments in the ^{235}U isotope of 5% or less. A variety of geometries and materials were considered. The code input parameters and the 16-energy-group cross sections are included. It is concluded that the code and cross sections are adequate and that reliable criticality safety calculations may be made for systems of general interest, provided the limits of validated applicability are not exceeded. (auth)

Transportation

10502 (ORNL-TM-1312(Vol.13)) STRUCTURAL ANALYSIS OF SHIPPING CASKS. Volume 13. CEIR: A Fortran Program for Estimation of the Response of Cylindrical Lead-Shielded Casks to End Impacts. Evans, J. H. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 26p. Dep. NTIS $4.50.

A Fortran computer program has been written to estimate the response of cylindrical shipping casks with lead shielding and steel or stainless steel cladding to the 30-ft free drop and end impact on an essentially unyielding horizontal surface. The development of this program, its use, and the results obtained are discussed herein. (auth)

10503 (Y-DD-152) SAFETY ANALYSIS REPORT FOR PACKAGING (OAK RIDGE Y-12 PLANT MODEL DT-2 PACKAGE FOR ENRICHED URANIUM). Dyer, H. R.; Mee, W. T. (Oak Ridge Y-12 Plant, Tenn. (USA)). 20 Jun 1974. Contract W-7405-eng-26. 25p. Dep. NTIS $4.00.

An analytical evaluation was made of the Y-12 Model DT-2 unirradiated enriched uranium metal shipping package to demonstrate its compliance with regulations governing the interstate transport of fissile materials. Comparison was made with a similar package design to indicate the structural integrity of the package in meeting the physical testing requirements described in the AEC regulations. The KENO computer code was used to analyze the criticality safety of the package containing up to 32 kg of uranium metal of any ^{235}U isotopic enrichment. Results of this evaluation show that the package complies with all applicable regulations. (auth)

10504 DUALLY SEALABLE, NON-LEAKING VIAL FOR SHIPPING RADIOACTIVE MATERIALS. Novitch, H. (to New England Nuclear Corp.). US Patent 3,811,591. 21 May 1974. Filed date 16 Oct 1972. 6p.

A dually sealable, non-leaking vial is described for shipping liquid radioactive materials, particularly sterile radioactive materials, and other sterile liquid materials in which the mouth of the vial, as shipped, is sealed by a needle pierceable septum seal and in which a threaded cap is located and held over the septum seal and mouth with the threads held out of engagement with mating threads on the vial by the septum seal. However, upon removal of the septum seal after shipment, the threads of the cap mate with the threads of the vial whereby the cap can be removably threaded tightly over the mouth to seal it. The capped and septum-sealed loaded vial is placed in a heat shrinkable plastic envelope having a bottom end wall and an upstanding cylindrical wall of greater height than the capped, septum-sealed vial and of lesser thickness than the bottom end wall and the envelope is heat shrunk circumferentially, tightly and sealably around the capped septum-sealed vial with the upper part of the envelope being shrunk circumferentially and downwardly tightly over the margin of the upper surface of the cap to securely seal the capped septum-sealed vial. (Official Gazette)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstracts 9627, 11449, and 11493.

10505 (CONF-740522-13) HIGH ENERGY POLARIZED BEAM AT THE ZGS. Khoe, T. K.; Kustom, R. L.; Martin, R. L.; Parker, E. F.; Potts, C. W.; Ratner, L. G.; Timm, R. E.; Krisch, A. D.; Roberts, J. B.; O'Fallon, J. R. (Argonne National Lab., Ill. (USA)). [nd]. 8p. Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Results of the acceleration of polarized protons in the Zero-Gradient Synchrotron are presented. The ion source, preaccelerator, 50-MeV polarimeter, beam extraction, and the high-energy polarimeter are described. At 50 MeV the measured beam polarization was 73% ± 6% and the optimum extracted beam polarization was measured at 6.0 GeV/c to be 73% ± 8%. (WHK)

10506 (CONF-740522-18) PROGRESS REPORT ON THE NAL ENERGY DOUBLER DESIGN STUDY. Edwards, D. A.; Fowler, W. B.; Reardon, P. J.; Richied, D. E.; Strauss, B. P.; Sutter, D. F. (National Accelerator Lab., Batavia, Ill. (USA)). May 1974. Contract AT(49-8)-3000. 12p. Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

For close to a year and a half, a study has been in progress at NAL to examine the feasibility of constructing the "Energy Doubler" — an accelerator employing superconducting magnets which would increase the energy of protons available at the Laboratory substantially above that provided by the present accelerator system and possibly to 1000 GeV. A report on the progress to date and on plans for continuing the study in the immediate future is presented. (auth)

10507 (CONF-740522-21) NAL ACCELERATOR AND FUTURE PLANS. (National Accelerator Lab., Batavia, Ill. (USA)). May 1974. Contract AT(49-8)-3000. 12p. Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

The NAL 300- to 500-GeV accelerator has achieved full operation with an intensive high-energy-physics experimental program in progress. The current operation of the accelerator and experimental areas is described as well as the present plans for improvement to achieve the design goals. The Laboratory is also working on longer range projects to achieve an accelerated beam of higher energy and to use this capability in a new experimental area and in a colliding-beam facility. (auth)

10508 (DEU-73-31) ANNUAL REPORT 1972. Konecny, E.; Hartmann, J.; Hering, W. (comps.). (Muenchen Univ. (F. R. Germany); Technische Univ., Muenchen (F. R. Germany)). 1973. 186p. (In German).

The third annual report gives an account of the activity during 1972. The MP tandem accelerator was primarily available throughout the whole year for the experiments. The great flexibility of the accelerator device enabled the working of an extensive scientific program. The following topics are individually dealt with: operational survey of the accelerator equipment, heavy ion reactions, nuclear reactions with light particles, nuclear fission, biophysical investigations as well as theoretical works on these topics. (INIS)

10509 (IAE-2203) PRELIMINARY RESULTS OF EXPERIMENTAL INVESTIGATION OF THE TUM ELECTRONIC MODEL. Veselovzorov, A. N.; Morozov, A. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1972. 16p. (In Russian). INIS.

A description is given of an experimental unit of an electronic model of tubular, multilens accelerators (TUM-10) along with preliminary results of operating the experimental equipment and of qualitatively confirming the effect of magnetically focusing the electron beam. A description is given of features of the magnetic system consisting of inner and outer current coils, a vacuum system assuring a vacuum of 4×10^{-5} mm Hg std during testing, and an electron beam with a special coordinator for displacing the beam within the vacuum chamber. Results are presented on a study of the magnetic field and of the dynamics of the electron beam. A comparison of experimental and calculated data showed a qualitative agreement of experimental data with calculated values in the "middle" part of the TUM-10 model. The data indicate the efficiency of using magnetic focusing of the electron beam in TUM-10. (SJR)

10510 (IPP-0-12) COMPUTATION OF ACCELERATING ELECTRODES FOR A RELATIVISTIC HIGH-CURRENT ELECTRON BEAM TUBE. Dommaschk, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). May 1973. 24p. INIS.

For an axisymmetric high-current electron beam source with a plane field emission cathode, accelerating field structures around stationary beams of high quality are computed. For this purpose, firstly a sufficiently self-consistent mathematical model for the beam is given. The potential is then continued into the region outside the beam. As in Pierce systems, the surfaces of corresponding accelerating electrodes are determined by equipotential surfaces. The indicated beam model includes self-magnetic fields. It is determined by a system of analytic differential equations which is numerically integrated, except near the cathode, where power series expansions were obtained with the aid of the formula manipulating capability of the computer. The continuation of the potential was made numerically stable by a method due to Garabedian by extending the computation into a fictitious complex domain. (GE)

10511 (IPP-0-13) DEVELOPMENT OF A 1 kA, 2 MeV ELECTRON BEAM TUBE. Andelfinger, C.; Ott, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). May 1972. 15p. (In German). INIS.

A tube for the Febetron Marx generator is described that yields a 1 kA, 2 MeV electron beam with high brightness and good reproducibility from shot to shot. The tube works in a poor vacuum and does not need a Lenard window for the beam exit. These windows limit the lifetime of commercial tubes to a few hundred shots. (GE)

10512 (ITEF-960) EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE BEAM DYNAMICS IN THE LINEAR I-2 ACCELERATOR AND THE DEVELOPMENT OF NEW ACCELERATOR ASSEMBLIES. Kapchinskii, I. M.; Batalin, V. A.; Lazarev, N. V.; Bobylev, V. I.; Danil'tsev, E. N.; Kartsev, L. V.; Kozodaev, A. M.; Koloskov, V. V.; Kuibida, R. P.; Edemskii, V. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1972. 71p. (In Russian). INIS.

Features of research work are presented for the year 1971 on experimental and theoretical studies of beam dynamics in the linear I-2 accelerator and the development of new accelerator assemblies. Accelerator development work is described and summarized. An analysis of the operability of all technical systems is given. In 1971 the accelerator operated more than 5000 hours. Shutdown time was only 2.5% of the total operating time. The average beam current per cycle was raised to 150 mA at the end of 1971. The basic directions of research were experimental studies of proton beam dynamics in the linear accelerator, improvements in beam measurement, and the introduction of a second channel for proton beam ejection to the atmosphere. A large number of improvements which have increased the reliability of the accelerator as a whole have been introduced in separate technical systems. Work has been started on modernizing the adjustment channel to increase the intensity and phase density of the accelerated beam. (SJR)

10513 (ITEF-964) USE OF AZIMUTHAL MAGNETIC FIELD IN AN ELECTRON RING ACCELERATOR. Globenko, Yu. G.; Koshkarev, D. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1972. 12p. (In Russian). INIS.

A study is presented on the effect of the B_θ-field on focusing of an electron ring loaded with ions. It is shown that the B_θ-field leads to binding of free oscillations along both degrees of freedom. In this case a particular frequency of the transverse oscillations is split into two, one of which increases with a rise in B_θ and the other falls. An analysis of the bound and unbound ($B_\theta = 0$) movements on the phase plane showed that bending of the beam did not change on introducing the B_θ-field. The introduction of the B_θ-field in order to stabilize coherent instabilities leads to binding of coherent oscillations along both degrees of freedom. Since the practically attainable value of the B_θ-field is limited, an analysis was carried out for $B_\theta/B_\chi < 1/2$. At these values the dipole coherent resonance is split into two, and as a whole the region of stability increases somewhat. Consideration is also given to the possibility of stabilization of large B_θ/B_χ for a ring with symmetrical oscillation frequencies. (SJR)

10514 (LA-5535-C) PROCEEDINGS OF THE SYMPOSIUM ON PRACTICAL APPLICATIONS OF ACCELERATORS, CLINTON P. Anderson Meson Physics Facility, August 27–31, 1973. Schillaci, M. E.; Harper, K. H. (eds.). (Los Alamos Scientific

Lab., N. Mex. (USA)). Mar 1974. Contract W-7405-eng-36. 417p. (CONF-730849-). Dep. NTIS $10.60.

Separate abstracts were prepared for 17 of the 21 papers presented. Four of the papers were previously abstracted in NSA Vol. 29: 13311, 16889, 16449, and 21704. (WHK)

For abstracts of individual papers see: 9088, 9797, 10070–10073, 10436, 10478, 10515, 10569–10571, and 10905–10909.

10515 (LA-5535-C, pp 63-73) USES OF A COMPACT CYCLOTRON IN A COMMUNITY HOSPITAL. Hupf, H. B. (Mount Sinai Medical Center, Miami Beach, FL). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

The use of cyclotrons for producing radioisotopes for nuclear diagnosis is briefly discussed. Performance ratings for three fixed-energy, positive-ion AVF cyclotrons made by the Cyclotron Corporation are listed. (WHK)

10516 (UCRL-75337) ELECTRON AUTOACCELERATION. Briggs, R. J.; Fessenden, T. J.; Neil, V. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1974. 6p. (CONF-740522-16). Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Theoretical and experimental studies of autoaccelerating electrons in an iris loaded pipe are described. The theory is based on a self consistent one dimensional hydrodynamic model. The computational results indicate that some particles may be accelerated to several times their initial energy provided the proper current vs time is injected, and the initial particle energy is high enough to limit the growth of longitudinal density fluctuations to a tolerable level. An experimental study of the interaction of an intense 3-MeV electron beam with a simple multicavity structure is described, where autoacceleration of some particles by the excited longitudinal rf fields was observed. (auth)

10517 FALLOUT FROM SMASHING ATOMS. Valery, N. New Sci.; 62: No. 897, 306-308(9 May 1974).

For three days in April 1974 the CERN laboratories were open to engineers from industry so that they could see some of the advanced engineering components and special design techniques concentrated there. The problem facing the CERN team is essentially one of having to build, rather infrequently, very large non-standard pieces of equipment, many of the performance specifications of which are 3 to 10 times more stringent than previously. Among examples of this technology which are described are: the ISR vacuum system with 10^{-11} torr around the full circumference of both rings and with 10^{-12} torr or better in the intersection regions, superconducting magnets built for the CERN 3.7 meter bubble chamber and the Omega Spectrometer, and particle detection with the multiwire proportional chamber. (UK)

10518 RADIOTHERAPY LINEAR ACCELERATORS: HISTORY, PRINCIPLES, AND CONTEMPORARY DEVELOPMENTS. Karzmark, C. J. (Stanford Univ., CA). pp 35-36 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

A very brief review of the historical development of linacs and their use in radiotherapy is given. (WHK)

10519 INSTALLATION, OPERATION, AND MAINTENANCE OF THE L. A. CLINAC 4 AT INSTITUTO DE RADIOTERAPIE, OSVALDO CRUZ. Lederman, M.; Vizeu, D. M. (Instituto de Radioterapia Osvaldo Cruz, Sao Paulo, Brazil). pp 79-83 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

Why this linear accelerator was installed; the difficulties in the initial work for its implementation; and also why this particular apparatus was chosen and the development of a basic structure to obtain a high standard of radiotherapy are discussed. (auth)

10520 STATUS OF THE DARMSTADT PROJECT. Armbruster, P. (Gesellschaft fuer Schwerioenforschung mbH, Darmstadt). pp 236-253 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

The history and status of the Universal Linear Accelerator (UNILAC) to be built at Darmstadt are reviewed. The layout of the projected laboratory and some general specifications for the proposed accelerator are shown. Finally, three special topics in the experimental program are set out: isotope production, fission studies by kinematic coincidences, and detection of superheavy quasi-atoms. (10 figures) (RWR)

10521 NEW ACCELERATOR FACILITY IN REHOVOTH. Goldring, G. (The Weizmann Institute of Science, Rehovoth, Israel). pp 254-266 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

The ideas behind the accelerator have evolved with time. Even now, the project is more an expression of directions and aims than rigid targets for achievement. The facility is now conceived as a two-stage operation. The first stage is a 14 UD Pelletron accelerator; the second, a superconducting linear accelerator to be operated as a post accelerator to the Pelletron. The aims, hopes, and still-open questions concerning the project are portrayed. (7 figures, 1 table) (RWR)

Auxiliaries and Components

10522 (CONF-740522-11) PHASOR: A CONTROL COMPUTER METHOD FOR DISPLAYING AMPLITUDE AND PHASE OF RIPPLE COMPONENTS IN THE RING MAGNET VOLTAGE. Lewis, L. G.; Valente, A. D. (Argonne National Lab., Ill. (USA)). [nd]. 6p. Dep. NTIS $4.00.

From ninth international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Deviations of 12-phase generator-transformer-rectifier systems from ideal performance result in the generation of ring magnet ripple at the fundamental and at low harmonics of the generator frequency. Analysis and display of the amplitude and phase of each of these harmonic components make it possible for the systems engineer to minimize the ripple by readjusting the control system. The Zero Gradient Synchrotron (ZGS) control computer samples both the filtered voltage on the ring magnet and a reference voltage produced by a phase-lock loop connected to the generator bus. Data are taken during a selected interval of the ZGS cycle and are then analyzed. Computer driven graphic displays plot the raw ripple data, amplitude and phase bar graphs for each harmonic component, reconstructed ripple data for checking, and graphs for comparing ripple components under different operating conditions. Numerical information is also displayed. The PHASOR program corrects the phase angles for the phase shifts produced by the ZGS passive filter. These corrected angles indicate which of the 12-phase firing angles should be retarded or advanced to reduce the ripple. (auth)

10523 (CONF-740522-15) DEVELOPMENT OF THE SUPERCONDUCTING HELIX FOR HEAVY-ION ACCELERATION. Aron, J.; Benaroya, R.; Bollinger, L. M.; Cliffi, B. E.; Despe, O.; Jaffey, A. H.; Johnson, K. W.; Khoe, T. K.; Livingood, J. J.; Markovich, P. J.; Nixon, J. M.; Parker, G. W.; Wesolowski, W. A. (Argonne National Lab., Ill. (USA)). 1974. 6p. Dep. NTIS $4.50.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Recent progress in the development of the superconducting helix for heavy-ion acceleration is reported. Accelerating fields in $\lambda/2$ resonators have been pushed up to 4.6 MV/m. Phase control by means of a voltage-controlled reactance has been refined to the extent required for helix structures appropriate for projectiles with $\beta \geq 0.07$. Protons have been accelerated in a prototype accelerator consisting of two independently-phased resonators; phase control was maintained with ease, and no unforeseen problems were encountered. A prototype accelerator consisting of three independently-phased resonators, one of which is a $5\lambda/2$ unit, is nearing completion. This system will accelerate O^{5+} ions from an FN tandem. (auth)

10524 (FEI-339) HIGH VOLTAGE SHORT PULSE GENERATOR WITH HIGH REPETITION FREQUENCY. Kononov, V. N.; Metlev, A. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1972. 5p. (In Russian). INIS.

A pulse generator is described with an amplitude up to 1.8 kV, a variable duration of 20 to 150 ns, and a following pulse frequency up to 800 kHz. The generator was used to interrupt the ion beam of a Van de Graaff accelerator by means of which it was possible to complete nuclear experiments with the use of a nanosecond technique for the time of flight. (SJR)

10525 (IFVE-INZ-73-21) STUDYING CAVITY WALL DEGASSING OF I-100 PROTON LINAC CONTAMINATED WITH

ORGANIC SUBSTANCES DURING POLISHING. Mirzoev, K. G.; Rogozinskii, V. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 14p. (In Russian). INIS.

An analysis is presented of the degassing curves for the surface of copper resonators of the I-100 proton accelerator, which were contaminated with organic substances during polishing. On the basis of the data from the analysis, a method is presented for calculating the degassing time for a given degree of decontamination and the gas removal flow at a given temperature, and also the amounts of organic contaminants obtained from vacuum chambers treated in an analogous manner are given. (SJR)

10526 (IFVE-INZ-73-40) VACUUM SYSTEM WITH TITANIUM PUMPS FOR HYDROGEN PUMPING. Mirzoev, K. G.; Rogozinskii, V. G.; Ushkov, V. L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 10p. (In Russian). INIS.

A study is made on a vacuum system for pumping hydrogen at a rate of 1000 to 1500 cm^3 (normal)/hr with continuous feed through the ion source of the injector of the I-100 linear proton accelerator. This system consists of two NEM-IT pumps and a getter pump whose pumping rate is 10^4 l/s at 1×10^{-6} torr. This system operates stably at a flow up to 500 cm^3 (normal)/hr and a pressure less than 1×10^{-5} torr. With pulse hydrogen feeding through the source at a frequency of 0.125 hertz, pumping is taken care of by the two NEM-IT pumps at an average pressure of 1.6×10^{-6} torr. Data are presented on the long-term operation of the NEM-IT pumps evacuating hydrogen in the pulse mode. (SJR)

10527 (IFVE-INZ-73-41) STUDY ON THE MAGNETO-GAS-DISCHARGE PUMP NEM-IT ON THE I-100 LINAC VACUUM SYSTEM. Krokhina, O. N.; Mirzoev, K. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 8p. (In Russian). INIS.

Characteristics of NEM-IT, titanium pumps are presented after long-term operation on the resonators of a linear accelerator. From crater measurements on the cathode disks the effective sputtering coefficient of titanium is determined in the chamber of the electrodischarge pump. On the basis of pump operating experience on the linear accelerator a determination was made of the pump operating time before the appearance of defects, and of the stable operating time of the vacuum system at a pressure of 0.5×10^{-6} torr. The maintenance time on these pumps was also determined. (SJR)

10528 (IFVE-SKU-73-39) STUDY OF PUMPING CHARACTERISTICS OF MAGNETO-GAS-DISCHARGE PUMP NEM-300 WITH GAS MIXTURE BY TWO OMEGATRON METHOD. Bulgakov, M. K.; Rogozinskii, V. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 12p. (In Russian). INIS.

A study is presented on the pumping characteristics of the magneto-gas-discharge NEM-300 pump with a mixture of gases by the method of two omegatrons (pressure indicators) on injecting air and oxygen into the pump. It is shown that the partial rate of pumping down oxygen exceeds the rate of pumping out nitrogen by a factor of 3 to 5. At the same time the pump-down rate for a gas mixture on injecting air and oxygen measured by the method of two pressure indicators is close to the calculated pump-down rate. From the results it follows that measuring the pump-down rate by the method of two pressure indicators gives a more complete representation of the pump-down process. (SJR)

10529 (JINR-13-7015) SYSTEM OF BEAM MONITORING BY ANALOG METHOD WITH PROPORTIONAL CHAMBERS. Zanevskij, Yu. V.; Ivanov, A. B.; Mikhailova, M. N.; Peshekhonov, V. D.; Filatova, N. A.; Chernenko, S. P.; Shirokov, B. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1973. 14p. (In Russian). INIS.

A system of two proportional chambers and electronic recording apparatus is described. It is used for adjusting an isolated beam. The beam pulse duration is 10^{-6} sec. In each chamber are 48 wires with a 1.5-mm gap. It is sensitive to a minimum signal of ~8 mV and has a dynamic range of 256:1. (tr-auth)

10530 (JINR-P16-7834) CONCRETE SHIELDING OF THE ELECTRON ACCELERATORS WITH ENERGIES 0.5 TO 10 MeV. Tsovbun, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Data are presented on the layers of the tenfold weakening of the bremsstrahlung in ordinary concrete. The data were calculated by the method of "competing lines" for the electron accelerators with energies 0.5, 1, 1.5, 2 and higher up to 10 MeV, in 1 MeV steps, and for the radiation angles from 0 to 70°, the step being 10°. (auth)

10531 (KEK-73-2) RESONANT NETWORK FOR THE KEK BOOSTER SYNCHROTRON MAGNET. Sasaki, H.; Takikawa, K.; Kumada, M. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan). Feb 1973. 56p. Dep. NTIS (US Sales Only) $6.00.

The resonant network for the KEK booster synchrotron magnet is analyzed, with a special emphasis on the dynamic behavior of the network. A design study on a concentrated energy-storage-choke is also described. Uniform ac excitation requires strong magnetic coupling between windings in the choke. Measurements show that the coupling coefficients between secondary windings in the choke are better than 0.9985. (auth)

10532 (KFK-EXT-3-74-3) MECHANICAL EXCITATION OF SUPERCONDUCTING HELIX RESONATORS BY EXTERNAL SOURCES WITH SLOWLY CHANGING FREQUENCY. Schulze, D.; Hornung, A. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Feb 1974. 25p. (In German). Dep. NTIS (US Sales Only) $4.25.

Helix resonators, which are used for rf-acceleration of protons and heavy ions, are very sensitive to mechanically induced disturbance sources. In particular, it is shown that sources with slowly changing frequency may lead to considerable resonant amplitudes even if the mechanical resonance is passed very fast. Thus, a substantial distortion of the operating accelerator is to be expected. A further enhancement may result, if the resonance is passed several times in short intervals. This cumulation effect is particularly efficient for superconducting niobium cavities, whose mechanical damping factor at low temperatures is two orders of magnitude smaller than at room temperature. In addition to a theoretical analysis and model measurements, countermeasures are discussed. (auth)

10533 DEVICE FOR THE AUTOMATIC CONTROL OF THE HIGH-VACUUM SYSTEM OF A 2 MV VAN DE GRAAFF GENERATOR. Schulz, G. (Amt fuer Standardisierung, Messwewen, Ger.). Isotopenpraxis; 10: No. 2, 70-71(Feb 1974). (In German).

A block diagram of the vacuum system with the signal flux between the structural units is given and the function of each unit is described. The operation of the high-vacuum system with its automatic control device is discussed. (JSR)

10534 ELECTROMAGNET WITH WINDINGS EMBEDDED IN AND INSULATED BY COMPRESSIVELY STRESSED CONCRETE. Sheldon, R.; Stapleton, G. B. (to Science Research Council). US Patent 3,808,569. 30 Apr 1974. Priority date 12 Jun 1968, United Kingdom of Great Britain and Northern Ireland. 4p.

In electrical apparatus subject to nuclear radiation, electrical conductors in particular for the magnet coils of an accelerator are mechanically supported and electrically insulated from one another by concrete held under permanent compressive stress. (Official Gazette)

Ion Sources and Injection and Extraction Systems

10535 (CERN-74-13) DIPOLE SEPTUM MAGNETS. Keizer, R. L. (European Organization for Nuclear Research, Geneva (Switzerland)). 21 May 1974. 36p. Dep. NTIS (US Sales Only) $5.00.

The two-dimensional theory of septum magnets is treated with the aim of arriving at a better understanding of how linearization of end fields may be achieved. Two practical applications, i.e., mirror plates and extended septa, are discussed. A method of extending the theory of linearized end fields to multiturn septa is given. Based on the above theory, the calculation of field errors arising from finite permeability effects and septum geometry is then shown to be possible by simple hand calculation. Various methods of correcting these field errors are indicated. Several septum constructions are shown and their specific difficulties discussed. (auth)

10536 (CONF-740522-14) EXTRACTION FOR THE MAIN RING AT NAL. Andrews, R. A.; Edwards, H. T.; Fisk, H. E.; Hornstra, F.; McCarthy, J. D.; Pfeffer, H.; Rode, C. H.; Walton, J. (National Accelerator Lab., Batavia, Ill. (USA)). May 1974. Contract AT(49-8)-3000. 6p. Dep. NTIS $4.00.

From 9th International conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Significant improvements have been made in the efficiency, duty factor, and flexibility of the NAL Main Accelerator extraction system, consistent with the increasing intensity of the synchrotron and the growing diversity of the experimental program. Currently, a typical extraction mode will include a one-second period of slow extraction punctuated by four higher intensity bursts for bubble chamber use, followed by a high intensity fast terminal spike for neutrino experiments. The extraction efficiency—now some

97% —is such that radioactivity levels in extraction system components are not increasing despite operation of the accelerator at record currents. A modified septum design is expected to lead to further gains. A computer-assisted feedback system has raised the spill duty factor to 70%. Recently, the synchrotron has been operated with a front porch, with two periods of slow extraction, each of one-second duration, at two different energies within the same accelerator cycle. (auth)

10537 (CONF-740522-19) BEAM EXTRACTION. Edwards, H. T. (National Accelerator Lab., Batavia, Ill. (USA)). May 1974. Contract AT(49-8)-3000. 4p. Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Methods for beam extraction from synchrotrons are reviewed. Resonance extraction and fast extraction are considered, and the beam spill structure and extraction efficiency are discussed. (WHK)

10538 (IFVE-SKU-73-11) MULTI-TURN INJECTION INTO THE 76-GeV PROTON SYNCHROTRON. Ado, Yu. M.; Zaitsev, V. I.; Ovchinnikov, M. F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 26p. (In Russian). INIS.

Consideration is given to a 2-revolution and 3-revolution injection into the proton synchrotron IHEP with the use of existing inlet systems under conditions of a stepwise change in deflecting fields. The injection efficiency is presented as a function of the accelerator acceptance. It is shown that with an acceleration acceptance in the interval from 2.1 cm mrad to 3.8 cm mrad a 2-revolution injection is suitable, while 3-revolution injection is suitable at an acceptance greater than 3.8 cm mrad. Basic requirements for injection systems are formulated. (SJR)

10539 (ITEF-29) MEASUREMENTS OF THE BEAM EMITTANCE AT THE I-2 LINEAR ACCELERATOR EXIT. Batalin, V. A.; Kujbida, R. P.; Sherman, V. E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 20p. (In Russian). INIS.

A description is given of the measurements of the beam emittance of ions at the exit of a linear accelerator by the method of two slits with the use of focusing and correcting ion-conducting devices for parallel transfer and scanning of the beam. Measurement results are presented for a beam current of 180 mA. (SJR)

10540 (RL-74-48) PROTON DUOPLASMATRON ION SOURCE FOR THE PREINJECTOR OF THE NEW INJECTOR FOR NIMROD. Fowler, R. G.; Sidlow, R.; Soulby, G.; West, N. D. (Science Research Council, Chilton (UK). Rutherford High Energy Lab.). Mar 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

A duoplasmatron ion source is described which will be used on the preinjector of the new injector for Nimrod. The source has been operated on a test rig and has given a pulsed beam of over 200 mA at an extraction voltage of 45 kV for pulse lengths of up to 500 μ sec. The results of beam emittance measurements using a photographic method are presented and the effect of plasma boundary distortions on the shape of the beam in phase space is discussed. (auth)

Ion Optics and Field Calculations

10541 (CONF-740522-23) TRANSVERSE SINGLE PARTICLE INSTABILITY IN THE NAL 500-GeV ACCELERATOR. Stiening, R.; Wilson, E. J. N. (National Accelerator Lab., Batavia, Ill. (USA)). May 1974. Contract AT(49-8)-3000. 5p. Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Experiments reveal that single particle resonances driven by field imperfections limit the 8 GeV acceptance of the NAL main accelerator to protons with betatron oscillation amplitudes less than 8 mm. It is observed that resonances driven by random azimuthal field fluctuations are much weaker than those driven by average field errors acting in concert with the superperiodicity of the accelerator. This consideration dictates the choice of operating tune. Correction magnets are installed to compensate zero harmonic skew quadrupole, sextupole and octupole errors. Separate control of dv_x/dp, dv_y/dp, d^2v_x/dp, and d^2v_y/dp is possible in an energy-dependent manner. High azimuthal harmonic patterns correction magnets are used to eliminate dipole, quadrupole, sextupole, and skew sextupole resonances adjacent to the operating point. A description of these systems and the improvements obtained are given. (auth)

10542 (CONF-740522-24) TRANSVERSE COLLECTIVE INSTABILITY IN THE NAL 500-GeV ACCELERATOR. Stiening, R.; Wilson, E. J. N. (National Accelerator Lab., Batavia, Ill. (USA)). May 1974. Contract AT(49-8)-3000. 3p. Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Vertical collective beam instability occurs during 8-GeV injection into the NAL main accelerator with an intensity threshold of approximately 10^{12} protons and a tune spread of 0.01. Horizontal collective instability has been observed at 5×10^{12} protons with a 0.01 tune spread. Sextupole, octupole, and active feedback damping have been used to control these instabilities. A brief description of these methods and the results obtained is given. (auth)

10543 (IPP-0-15) ELECTRON RING ACCELERATOR WITH PULSED COMPRESSION INTO A STATIC FIELD. Herrmann, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). 1973. 18p. INIS.

An electron ring accelerator is described that combines pulsed compression and static magnetic field acceleration. The model is calculated in detail, and an arrangement of coils is found that actually compresses rings into the static field system. Care has been taken to cross the coupling resonances at $n = 0.2$ and $n = 0.1$ with small growth rates. In addition, Landau damping coefficients for resistive-wall instabilities are calculated. The model uses 7 pulsed coils for compression and ring transport into the so-called "Wartesaal," a magnetic mirror, where the ring is kept to allow multiple ionization. One additional coil is needed for roll-out. The large number of coils does not pose a serious problem; the timing of the coils has only to be within a tolerance of ±100 ns. (GE)

10544 (IPP-0-16) FOCUSING AN ELECTRON RING IN THE PRESENCE OF A SQUIRREL CAGE AND A CONDUCTING CYLINDER. Hofmann, I. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Mar 1973. 17p. INIS.

The focusing fields due to image charges and currents on a squirrel-cage-type conductor outside a relativistic electron ring and on a conducting cylinder inside the ring are calculated using a thin ring approximation. The resulting image contributions are then compared with the self-field effects and an estimate is given for the Landau-damping coefficient. (GE)

10545 (IPP-0-18) HOLDING POWER OF A RELATIVISTIC ELECTRON RING. Merkel, P. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Oct 1973. 13p. INIS.

The maximum acceleration of ions possible in an electron ring accelerator is studied. The case of slender rings without external focusing is treated in beam approximation using macroscopic fluid equations. The acceleration forces are taken as a perturbation acting on an unaccelerated equilibrium. The dependence of the maximum acceleration on the ion loading and electron energy is discussed. At the Budker limits no acceleration is possible, while over a wide range in between the maximum acceleration is only weakly dependent on the ion loading. (GE)

10546 (ITEF-951) TRANSVERSAL DIPOLE OSCILLATIONS IN A CIRCULAR BEAM OF CHARGED PARTICLES. Zenkevich, P. R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1972. 16p. (In Russian). INIS.

Taking into account the frequency dispersion of particles, an analysis was made of the free transverse oscillations in a circular beam of charged particles held by internal electromagnetic forces depending on center-of-mass coordinates. Consideration is given to the possibility of obtaining information on the beam rotating in the chamber of an accelerator or accumulator, by experimentally investigating the free dipole oscillations. (SJR)

10547 (JINR-9-7084) AUTOMATIC ELECTROLYTIC TANK. Glazov, A. A.; Mareev, Yu. M.; Shakun, N. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 13p. (In Russian). INIS.

A device is described, and the possibilities of using an automated, electrolytic bath with analog-digital equipment are explored. Results are presented on a standardized experiment for modeling the electric field in the central region of a cyclotron. The device was manufactured in the new-accelerator section of LYaP. (SJR)

10548 (JINR-P9-7631) PROBLEM OF MAGNETIC FIELD FORCING IN THE TWO-STAGE REGIME OF NUCLEUS ACCELERATION WITH THE JINR SYNCHROPHASOTRON. Kazanskii, G. S.; Mikhailov, A. I.; Smirnov, A. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Problems are considered that are concerned with the possible realization in practice of the magnetic field forcing by the two-stage acceleration with the JINR synchrophasotron. This fact allows the acceleration up to relativistic energies of nuclei heavier than the He nuclei. (auth)

10549 (KEK-73-1) EDDY CURRENT EFFECTS IN THE BORE TUBES OF LINAC FOCUSING MAGNETS. Kobayashi, M.; Tanaka, J.; Yamashita, S. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jan 1973. 20p. Dep. NTIS (US Sales Only) $4.00.

The intensity and harmonic field quality of the secondary field created by eddy currents in the bore tubes of linac focusing magnets, and the resultant shift of the peak field timing were measured for different wall thickness of the tube. The observed eddy current effects are in a good agreement with the theoretical prediction. The focusing magnets for the low-energy end of the KEK linac have the stainless steel tube 0.8 mm thick at the radius of 10.4 mm. The distance between two opposite pole tips is 22 mm. If the exciting pulse has a half-sinusoidal shape with the width T = 1.3 nsec, the peak field will be reduced by 0.2% and the peak field timing will be shifted by several μsec, while they can be easily compensated by readjusting the charging capacitance and voltage of the power supply. (auth)

10550 (KEK-73-4) DESIGN OF THE FOCUSING SYSTEM FOR KEK LINEAR ACCELERATOR. Kobayashi, M. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Oct 1973. 42p. Dep. NTIS (US Sales Only) $5.25.

Design of the focusing system is described including the focusing scheme and strength, magnet design, tolerance for magnet misalignment and the expected emittance and acceptance. The focusing scheme of FDFD gives the acceptance of 19 mm · rad (normalized), which is twice larger than that obtained for FDDF. The shape of the emittance phase space can be controlled to a significant degree by changing the slope of the focusing program along the linac without affecting the shape of the acceptance phase space. The flux density gradient G_0 of 90 ~ 110 Wb/m^3 at the injection end is a reasonably recommendable value which has been achieved. (auth)

10551 (KEK-73-7) COHERENT INSTABILITY DUE TO IONS IN THE RESIDUAL GAS. Khoe, T. K. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Nov 1973. 15p. Dep. NTIS (US Sales Only) $4.00.

An elementary discussion is given of the instability of a circulating beam due to ions in the residual gas. Approximate values of the growth rate and the effect of Landau damping are given. The results are applied to estimate the threshold value of the number of particles that can be injected in the KEK main synchrotron. (auth)

10552 (KEK-73-8) ACCELERATION OF POLARIZED PROTONS IN THE KEK SYNCHROTRON. Khoe, T. K. Nov 1973. 23p. Dep. NTIS (US Sales Only) $4.25.

The depolarization of a polarized beam of charged particles during acceleration in a circular accelerator has been calculated. The results obtained using classical mechanics agree with the quantum mechanically derived expressions. For numerical examples, the resonant depolarization of protons in the KEK booster and main synchrotrons is considered. A method to avoid and/or to reduce depolarizations is suggested. (auth)

10553 (LA-UR-74-847) SIMULTANEOUS STEERING OF H^+ AND H^- BEAMS AT LAMPF. Crandall, K. R.; Jule, W. E. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. 2p. (CONF-740522-17). Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

Based on analysis and computer simulations, it has become apparent that two kinds of doublet steering are necessary for linear acceleration of H^+ and H^- beams simultaneously. The respective advantages of steering by electrically "tilting" and "displacing" a system of doublets are described. Single dipole steering for simultaneous beams and the effect of the earth's magnetic field on oppositely charged beams are also considered. Finally, the implementation of this kind of steering at LAMPF is discussed. (auth)

10554 (UCRL-Trans-1514) DISTRIBUTION FUNCTION OF IONS FORMED IN AN ELECTRON RING. Drozdovskii, A. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. Translation by G. Brodell of ITEF-10. 16p. Dep. NTIS $4.00.

The ion loading in an electron ring was studied. The ion distribution function inside the uniform electron ring was obtained. It is shown that the self-field of ions has no direct effect on their motion. Some properties of the electron-ion ring behavior are considered. (auth)

10555 THEORY OF THE STABILITY OF RELATIVISTIC ELECTRON BEAMS AND THE PROBLEM OF THE CRITICAL CURRENTS. Zhelyazkov, I. God. Sofii. Univ., Fiz. Fak.; 65: 81-104(1970). (In Bulgarian).

The production of high current electron beams is a working problem for contemporary high-power electronics. This paper studies the instabilities causing the reduction of the magnitude of the beam current. Formulas for the limiting currents of uncompensated cylindrical relativistic electron beams have been obtained. It is shown that upon compensation of the electron space charge the beam current can increase $(\epsilon/mc^2)^2$ times (ϵ being the energy of the beam electrons, m—the electron rest mass, c—the light velocity) with respect to the uncompensated beam current. The cause for the restriction of the current is the emergence of Buneman's or a current-convective instability, which depends on the beam's geometry and the value of the longitudinal external magnetic field, whose application is necessary for the prevention of the latitudinal spread of the beam. A comparison is made between the theoretical conclusions obtained and the data from experiments with nonrelativistics electron beams, which shows that the disagreement between theory and experiment is within the reasonable limits. (auth)

10556 TIME OF FLIGHT CHARGED PARTICLE OPTICS USING AN INHOMOGENEOUS, OSCILLATORY ELECTRIC FIELD. Carrico, J. P.; Mueller, R. K. (Bendix Research Labs., Southfield, MI). Phys. Lett.; 47A: No. 5, 427-428(22 Apr 1974).

Several time-of-flight properties of an inhomogeneous, oscillatory electric field are described which show promise of application in charged particle optical systems. (auth)

10557 ELECTRON TRAJECTORIES IN THE CIRCUMFERENTIAL MAGNETIC FIELD OF A BETATRON. Evstigneev, V. V.; Kashkovskii, V. V. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 141-143(1973). (In Russian).

Expressions were obtained for the trajectory and the angle of the developing spiral of an electron beam in the magnetic field of a betatron. These expressions made it possible to evaluate effectively the spatial distribution of the beam at the moment of extraction and to make an appropriate selection of the configuration of the controlling field of the betatron. (tr-auth)

10558 PHASE AND ENERGY PARAMETERS OF STORED-ENERGY ACCELERATORS. Zhileiko, G.I.; Movsisyan, L.M.; Sindinskii, V.V. (Moscow Power Engineering Institute). Sov. Phys.-Tech. Phys. 18: No. 7, 979-980 (Jan 1974).

The effective synchronous phase, the field, and the particle energy in the waveguide sections of an accelerator used to equilibrate the energy spectrum of particles in a bunch are calculated; the waveguide is excited by the self field of the particle beam. Working equations and an analysis are given for the case in which the dynamic slip phase varies linearly, allowing for losses in the waveguide walls and radiation losses. (auth)

Storage Rings

10559 (CONF-740522-20) INSERTIONS FOR COLLIDING-BEAM STORAGE RINGS. Lee, W. W.; Teng, L. C. (National Accelerator Lab., Batavia, Ill. (USA)). May 1974. Contract AT(49-8)-3000. 5p. Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

A new approach is presented for the design of the beam-collision straight sections of high-energy colliding-beam storage rings. Interchangeable special function lattice insertions are used to obtain local beam characteristics at the collision point to meet the requirements of individual experiments. Other insertions are used to adjust the phase advance and the orbit-length dispersion to optimize the performance of the rings. These insertions are modularized in length and matched to one another in optics and dispersion functions so that they can be inserted or joined together with maximum flexibility. Examples are given for 1000 GeV-1000 GeV superconducting magnet proton storage rings. (auth)

10560 (LBL-2688) PROPOSAL FOR A POSITRON-ELECTRON COLLIDING-BEAM STORAGE RING PROJECT (PEP). (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Stanford Linear Accelerator Center, Calif. (USA)). Apr 1974. Contract W-7405-eng-48. 149p. (SLAC-171). Dep. NTIS $5.45.

Results of a collaborative study by LBL and SLAC and the resulting proposal to construct a 15-GeV electron-positron storage ring to be compatible with the future addition of a 200-GeV superconducting proton storage ring to allow for positron-electron-proton colliding beam studies are presented. A cost estimate and a construction schedule are given. Also, physics with electron-positron colliding beams is discussed. (WHK)

Experimental Facilities

Refer also to abstracts 9628, 10475, 10476, 10977, and 10996.

10561 (CERN-74-11) DYNAMIC ORIENTATION OF NUCLEI AT LOW TEMPERATURES. A Study of the Mechanisms of Dynamic Polarization in Polarized Targets. de Boer, W. (European Organization for Nuclear Research, Geneva (Switzerland)). 13 May 1974. 67p. Dep. NTIS (US Sales Only) $6.50.

Thesis. Submitted to Univ., Delft, Netherlands.

A study was made of the mechanisms of dynamic orientation of nuclei in organic materials at temperatures below 1 K and magnetic fields up to 50 kG. After a description of the theory of dynamic polarization, the dynamic polarization experiments in diols, doped with paramagnetic Cr^{V}-complexes, are described. These measurements are compared quantitatively with a spin temperature model, in which it is assumed that the polarization of the nuclei is obtained via the thermal contact with a dynamically cooled electron spin–spin interaction reservoir. The role of such a reservoir was apparent from the transient behavior of various nuclear spin systems, contained in the same sample. The observed high polarizations (80 to 98% for protons, ~40% for deuterons and ~50% for carbon-13 nuclei) make this kind of material attractive for polarized targets. We observed a pure tensor polarization of deuterons in a solid. This was obtained by slightly off-resonance irradiation of the proton spin system in partially deuterated diols. The results could be understood quantitatively in terms of the spin temperature theory. At the end the dynamic polarization experiments with the free radical BDPA are described. The polarizations of different nuclei, measured as function of the microwave frequency, show clearly the contributions of different mechanisms of dynamic polarization. In all the experiments mentioned above, the concept of a spin–spin interaction reservoir appears to be useful, even under conditions where the polarization of the spin system approaches one. (auth)

10562 (COO-1195-287) REPORT OF THE LARGE-DETECTOR GROUP. (Illinois Univ., Urbana (USA). Dept. of Physics). 1973. 19p. (CONF-730740-1). Dep. NTIS $4.00.

From NAL summer study session; Aspen, Colorado, USA (9 Jul 1973).

It is recommended that NAL build at the earliest possible time the Large Aperture Detector Facility which is described. The detector is built around three large superconducting magnets separated by threshold Cherenkov counters, drift chambers and multiwire proportional chambers (MWPC's). The target will normally be placed just inside the first large magnet. Initially the target will be surrounded by MWPC's to detect charged particles over essentially the entire 4π solid angle. The apparatus in the target region will be easy to change from experiment to experiment; for example, optical devices such as a rapid cycling bubble chamber or streamer chamber could be used to study diffcult topologies. The momentum resolution for charged particles will be better than ±140 MeV/c for transverse momenta $P_T \leq 3$ GeV/c and longitudinal momenta $P_L \leq 180$ GeV/c. For reactions not requiring high resolution the range is considerably larger, for example, $p_T \leq 10$ GeV/c and $p_T \leq 600$ GeV/c for ±1.4 GeV/c resolution. This high resolution capability is complemented by various neutral detectors which not only will help differentiate between various reactions, but will allow the exploitation of many interesting final states normally not studied even at lower energies. (WHK)

10563 (GEPP-130) STRESSES ON ENCAPSULATED GLASS VACUUM TUBE AND HEADER. Spears, R. K.; Lusis, V. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). 18 Jun 1974. Contract AT(29-2)-656. 16p. Dep. NTIS $4.00.

An experimental stress analysis was performed on neutron tubes encapsulated in an epoxy resin to determine (1) if the stress on the header of the tube is sufficient to cause delamination from the encapsulant and (2) how a ½-inch vertical scratch purposely placed in the glass tube frame affects the state of stress. Electric strain gages were placed on the header and along the glass frame; then strain measurements were made at temperatures ranging from −65°F to +200°F after the unit was encapsulated and taken out of the mold. The results indicate that the header has a tendency to severely dish as the unit temperature approaches −65°F. At most temperatures, the tangential stress was compressive near the top of the tube frame and became tensile at the midsection of the tube. (auth)

10564 (IAE-2217) PROGRAM LIBRARY FOR EXPERIMENTAL DATA PROCESSING IN OPERATIONAL SYSTEM OS-M-220/IAE. Pasynkov, I. G.; Sakuta, S. B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1972. 24p. (In Russian). INIS.

A description is given of the complex of programs "Tsiklotron" by which it is possible to accomplish operative treatment of experimental data which are obtained in physical measurements on a cyclotron and are sent to a M-220 digital computer at the IAE computing center. With an input-output device, which is at the measuring building and is tied into the communications line through a Mozu interchange, an assignment is made for the required program and also the parameters of the experiment. Exchange of information begins on query from the experimental building, to which dispatcher M-220 reacts. On finishing the next problem which is completed by operators at the M-220 computer, the entrance of new problems is blocked by a perforated card, and the complex of programs "Tsiklotron" is called. The results of the calculation are sent to ATsPU of M-220 and the Mozu interchange of the measuring building, from which they can be sent to an electron-beam tube or an input-output unit which includes an electric typewriter and a paper tape perforator. (SJR)

10565 (IAE-2230) SIMULATION OF THE PSEUDORANDOM METHOD FOR NEUTRON PULSE SOURCE SPECTROMETRY. Muradyan, G. V.; Adamchuk, Yu. V.; Shchepkin, Yu. G.; Voskanyan, M. A.; Ustroev, G. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1972. 12p. (In Russian). INIS.

The suitability of using a combination of the classical method of neutron spectrometry from the time of flight along with the pseudorandom method for measuring the resonance capture cross-section was confirmed at the IAE electron linac facility. It is shown that for these measurements the combined method gives greater accuracy in comparison with the classical method. (SJR)

10566 (IFVE-OP-73-10) PRELIMINARY RESULTS OF THE IFVE ACCELERATOR OPERATION WITH SEPARATED BEAMS. Bernard, F.; Grant, A.; Lazeras, P.; Langeler, G.; Mareshal, B.; Prela, G.; Galynev, N. A.; Zelenin, V. E.; Kotov, V. I.; Prilepin, A. A.; Prosin, B. V.; Khodyrev, Yu. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 13p. (In Russian). INIS.

Preliminary results are presented on forming a beam of separated particles on the IHEP accelerator for the bubble chamber "Mirabel" of Saclay (France). Data are given on parameters of the particle beam, high frequency separator, and engineered outlet from conditions of optimum acceptance of the particle beam to the region of pulses of 30 GeV/c at the maximum possible value of the deflecting high-frequency field. (SJR)

10567 (IFVE-SEF-72-87) INVESTIGATION OF THE Λp INTERACTIONS AND INCLUSIVE PROCESSES IN THE IHEP ACCELERATORS. Experiment Design Project. Antipov, Yu. M.; Borisov, A. A.; Volkov, A. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 18p. (In Russian). INIS.

A design is described for a two-arm spectrometer Sigma with magnetostrictive spark and proportional chambers. The spectrometer can be used for studying the formation, interaction and decay of stable and unstable particles. As the first experiments on the spectrometer it is proposed that Λp-interaction be investigated and that the spectra of the particles (of the inclusive reactions) be measured. (SJR)

10568 (JU-RR-73-12) CARRIER-LOADED HELIUM-JET TRANSPORT METHOD. Aeystoe, J.; Puumalainen, P.; Valli, K. (Jyvaeskylae Univ. (Finland). Dept. of Physics). Jun 1973. 43p. INIS.

The suitability of commercial helium loaded with small amounts of different gases or vapors for the transport of radioactive reaction products over distances of several meters was investigated experimentally. Negative results were obtained with gaseous carriers. Transport efficiencies of 50 to 100% were obtained with carrier vapors. The vapor appears to form droplets in the system. The recoils are adsorbed physically by the droplets and carried with them through a capillary. There appears to be an active mechanism that forces the heavy constituents to the center of the capillary cross section. The heavy constituents emerge from the capillary as a very narrow beam. Collection of the transported activity onto a metal foil in a vacuum chamber is possible only when the vapor pressure of the carrier is lower than the pressure of the collection chamber. Vacuum pump oil was found to meet this requirement. The transport and collection efficiency was studied as a function of the relative mass throughput of the oil vapor. A method for determining the optimum mass throughput of the carrier is demonstrated. The internal energetics of the system are discussed. The kinetic energy of a particle to be transported has to be higher than the average thermal energy in order to avoid adsorption onto the capillary walls. This can be achieved by increasing the mass of the particle by means of a carrier or by decreasing the system temperature. In a cooled system, transport over long distances is possible even with pure helium. Application of the carrier-loaded transport method in on-line mass separators is discussed. (auth)

10569 (LA-5535-C, pp 23-46) ROLE OF THE LINAC IN PRODUCING PRACTICAL ISOTOPES. Gruverman, I. J. (New England Nuclear Corp., North Billerica, MA). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

A survey of the applications of isotopes and the role that LINAC processes may be expected to play in the future in producing isotopes for such applications is given. LINAC methodology for isotope production and its competitors is discussed. The criteria for selection of a production procedure are discussed and advantages and disadvantages of the LINAC process are cited. The various classes of isotope application and the need for isotopes in these applications are explored. A discussion of the isotopes which are available or which would be desirable is then entered, and the criteria for selection of isotopes to be prepared by LINAC processes are considered. Specific isotope candidates are listed and suggested priorities are set. (34 references) (auth)

10570 (LA-5535-C, pp 142-165) FISSIONABLE MATERIAL ASSAY USING MU-MESIC X RAYS. Malanify, J. J. (Los Alamos Scientific Lab., NM). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

The feasibility of a new nondestructive analysis technique which is capable of analyzing both the isotopic and the elemental concentration of bulk fissionable material is discussed. The technique is proposed for use at LAMPF. The sample is bombarded by a μ^- beam and the muonic x-ray spectra is measured. Status of the project is outlined. WHK)

10571 (LA-5535-C, pp 380-393) NEUTRON SPECTRAL MEASUREMENTS IN THE REGION FROM 5 TO 724 MeV. Madey, R.; Waterman, F. M. (Kent State Univ., Ohio). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

Neutron spectral measurements are presented from both thin and thick targets bombarded by protons from the 184-inch cyclotron at the Lawrence Berkeley Laboratory. Neutron spectra above 175 MeV from 724 MeV proton bombardment of thin beryllium and copper targets were measured at zero degrees with respect to the proton beam. Neutron spectra from 740 MeV proton bombardment of a 30-cm thick depleted uranium-238 target were measured from 20 to 500 MeV at 50 degrees and from 5 to 140 MeV at 130 degrees. The number of high-energy neutrons produced from the thick uranium target is significant in comparison with the number produced in the energy interval from 10 to 25 MeV. Comparison of both thin and thick target measurements with Monte Carlo calculations based on the intranuclear cascade-evaporation model shows that discrepancies exist in the cascade region. Neutrons from the beam-stop at the Los Alamos Meson Physics Facility (LAMPF) have been proposed for use in radiation damage studies of structural materials for both fast breeder and fusion reactors. The results suggest the need for neutron spectral measurements from the LAMPF beam-stop to aid in the interpretation of the proposed radiation damage studies. (auth)

10572 (PTB-ND-5) PROPOSAL FOR A GAS TARGET FOR NEUTRON PRODUCTION. Leung, M. K. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany)). Dec 1973. 31p. Dep. NTIS (U. S. Sales Only) $4.75.

The construction of a gas target for neutron production at 8 to 12 MeV based on the $T(p,n)^3He$ reaction is described. The neutron yield would be $\sim 2.7 \cdot 10^7$ neutrons/μA bar · sr at 8.8 MeV incident proton energy. The energy spread for the 10 MeV proton beam through the foils and the gas is ~100 keV. The ratio of background neutrons to neutrons from the gas target when the pressure is 1 bar is ~1:1.5. Two types of gas targets are to be constructed. The first type can withstand about 3 μA of beam current, and the second 25 μA of current. (WHK)

10573 (TLU-9-73) NEUTRON TIME-OF-FLIGHT FACILITY AT THE UPPSALA TANDEM ACCELERATOR. Conde, H.; Persson, L. E.; Stroemberg, L. G.; Lindholm, A.; Lodin, G.; Nilsson, L.; Nordborg, C. (Tandemacceleratorlaboratoriet, Uppsala (Sweden)). Aug 1973. 27p. INIS.

The main features of the neutron time-of-flight facility at the Uppsala Tandem Accelerator are described in some detail. Special construction details along the beam tube as well as target and detector arrangements are described. The scientific program maintained at and planned for the facility is presented together with some typical data obtained up to now. (INIS)

10574 (UPTEC-73-27-R) EXPERIMENTAL SYSTEM FOR BACKSCATTERING AND CHANNELING MEASUREMENTS. Petersson, S.; Sundqvist, B. (Uppsala Univ. (Sweden)). May 1973. 16p. INIS.

A system for back-scattering and channeling measurements is described. The main component of the system is a scattering chamber with a two axis goniometer especially constructed for these measurements. The whole experimental system has been tested and found to work satisfactorily. (auth)

10575 COLLIMATOR FOR HIGH ENERGY RADIATION. Barthel, R.; Offermann, B. P. (to Licentia Patent-Verwaltungs-G.m.b.H). US Patent 3,805,081. 16 Apr 1974. Priority date 16 Apr 1971, F. R. Germany. 4p.

A plurality of cells are disposed in an aperture insert which is receivable in an aperture of a collimator for high-energy radiation. The cells can be selectively filled with radiation shielding material. The collimator is designed to surround the target in an accelerator neutron source. (WHK)

10576 PREPARATION OF A SELF-SUPPORTING PLATINUM TARGET FOR GAMMA SPECTROSCOPIC EXAMINATIONS. Istvan, U. ATOMKI (At. Kut. Intez.) Kozlem.; 15: No. 3, 215-216(1973). (In Hungarian).

An irradiation target was prepared to obtain a new isotope, ^{188}Ir, on the basis of the $^{195}Pt(n,p)^{188}Ir$ reaction. As the isotope was expected to have a half-life of about 1 sec., the measurements had to be carried out very fast. A pneumatic tube was used to carry the specimen to a distance of about 3 m, starting the experiment within $\frac{1}{2}$ sec. after completion of the neutron irradiation. Since only about 150 mg of platinum enriched in ^{195}Pt was available, a special melting technique was developed, using a small alumina crucible. The droplet obtained was fashioned into a rod by means of a newly designed stainless steel tool. Specimens with a length of 3.5 mm and a diameter of 1.5 mm were prepared, maintaining the required chemical purity and keeping the material losses within 5 to 6 per cent. (TTT)

10577 TRITIUM DOSIMETRY AROUND NEUTRON GENERATORS WITH TRITIUM TARGETS. Khozyainov, M. S.; Seredin, Yu. V. (All-Union Scientific-Research Inst. for Nuclear Geophysics and Geochemistry, Moscow). pp 139-153 of Nuclear Geophysical and Geoacoustical Logging of Cased Boreholes in Additional Exploration of Oil and Natural-Gas Deposits. Moscow; Vsesoyuznii Nauchno-Issledovatel'skii Inst. Yaderno Geofizikii i Geokhimii (1973). (In Russian)

Literature data on radiation safety in the use of tritium targets in neutron generators were analyzed. The possible nature of charged air in work areas, the equipment, and the path of entry of tritium into workers' bodies were considered. Special attention is given to problems of individual and operative dosimetry of tritium in the air as tritium hydride, vapors of tritiated water, and aerosols. The method was studied on random samples and on air and water known to contain tritium. The possibility of using different measurement methods in systematic dosimetric control was examined. Such control was recommended for laboratories where tritium targets are used. (tr-auth)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Cosmic Radiation

Refer also to abstracts 9591, 9629, 10758–10760, 10818, 10819, 10844, 11011, 11444, 11483, 11586, and 11748.

10578 (CONF-730804-P1) 13TH INTERNATIONAL COSMIC RAY CONFERENCE, DENVER, COLORADO, 17–30 AUGUST 1973. Volume 1. OG Sessions. (Denver Univ., Colo. (USA)). 1973. 747p. Dep. NTIS $40.50.

Separate abstracts were prepared for the 112 complete papers in this volume. (WDM)

For abstracts of individual papers see: 10579–10679, 10753–10760, and 10817–10819.

10579 (CONF-730804-P1, pp 1-6) MEASUREMENT OF THE DIFFUSE PRIMARY GAMMA-RAY SPECTRUM. Schoenfelder, V.; Lichti, G. (MAX-Planck-Institut fuer Physik, Garching, Ger.). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

On February 27, 1973, a soft gamma-ray telescope (1 to 10 MeV) was launched from Palestine, Texas on a $20.11 \times 10^6 ft^3$ balloon. Principal of measurement of the telescope is the double Compton process. The telescope consists of two large plastic scintillator blocks 1.20 m apart. A gamma-ray event is identified by a first Compton collision in the upper detector and a second in the lower one, the sequence being confirmed by a time of flight measurement. The balloon stayed at top altitude of 2.45 g/cm^2 for three hours and then descended slowly to 10 g/cm^2 within three hours. First results of this flight on the total primary gamma-ray flux in the MeV-range are presented. (auth)

10580 (CONF-730804-P1, pp 8-13) DIFFUSE COSMIC GAMMA-RAY BACKGROUND ABOVE 20 MeV. Agrinier, B. (CEA, Paris); Forichon, M.; Leray, J. P.; Parlier, B.; Montmerle, T.; Boella, G.; Maraschi, L.; Sacco, B.; Scarsi, L.; Da Costa, J. M.; Palmeira, R. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

During three balloon flights the secondary gamma-ray flux produced by cosmic-rays in the atmosphere was monitored at two latitudes (43°N and 23°South). The growth curve as a function of the atmospheric pressure gives evidence for the presence of a residual gamma-ray flux at the top of the atmosphere: $I_\gamma(>20$ MeV$) = (1.33 \pm 0.4) \times 10^{-4}$ photon/cm^2.s.st. MeV, which probably represents an overestimate of the cosmic diffuse flux. (auth)

10581 (CONF-730804-P1, pp 14-19) DIFFUSE COMPONENT OF COSMIC GAMMA RADIATION > 10 MeV. Share, G. H.; Kinzer, R. L.; Seeman, N. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A spark-chamber telescope was flown from a balloon to an atmospheric depth of 2.5 $g\text{-}cm^{-2}$ over Argentina in 1971. The rate of events, assumed to be of γ-ray origin, was extrapolated to the top of the atmosphere and provided possible evidence for a residual flux of γ radiation above the atmosphere. However, a source of background has been discovered which can simulate this flux. The residual flux, 3×10^{-3} γ/cm^2-sec-sr is therefore an upper limit to the intensity of diffuse cosmic γ rays > 10 MeV. At 30 MeV, the upper limit to the differential flux is 3.5×10^{-5} γ/cm^2-sec-sr-MeV. (auth)

10582 (CONF-730804-P1, pp 21-26) MEASUREMENT OF THE DIFFUSE COSMIC GAMMA RADIATION. Heterich, W.; Pinkau, K.; Rothermel, H.; Sommer, M. (Max-Planck-Institut fuer Extraterrestrische Physik, Garching, West Ger.). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Observations of the diffuse gamma-ray flux were made during three balloon flights at altitudes between 1.8 and 2.2 g/cm^2. Flux values were calculated from the rate of clear electron pairs and a geometrical factor derived from accelerator calibrations. A (p,γ) reaction source was used in the 10 to 20-MeV energy range, a tagged beam of gamma rays was used in the 50 to 500-MeV range. The flux value for the diffuse radiation was determined at 40 MeV to be $F(40\text{ MeV}) = 4.4 \cdot 10^{-5}$ $(cm^2\text{ sec ster MeV})^{-1}$ assuming an isotropic distribution which is in agreement with the observed distribution of gamma rays. (auth)

10583 (CONF-730804-P1, pp 27-30) SIGNIFICANCE OF PRIMARY γ-RAYS FOR COSMIC-RAY ORIGIN. Strong, A. W. (Inst. of Nuclear Research, Lodz, Poland); Wdowczyk, J.; Wolfendale, A. W. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A possible explanation of the rapid change of slope of the primary cosmic-ray spectrum near 10^{15} eV is that it arises from interactions with the microwave background in an evolving Universe. The energy spectrum of the diffuse γ-ray background which would result from such interactions was calculated and compared with the experimental limits. Although the experimental data on the diffuse γ rays are rather imprecise what evidence there is indicates that the suggested process may well be correct. (auth)

10584 (CONF-730804-P1, pp 31-35) PULSED GAMMA-RAY FLUX FROM NP 0532 AT E GREATER THAN OR EQUAL TO 15 MeV. Helmken, H.; Hoffman, J. (Smithsonian Astrophysical Observatory, Cambridge, MA). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

By use of a balloon-borne low-energy gas-Cherenkov detector, a 3.3σ excess coincident within 1 msec of the main optical pulse of the pulsar has been observed. Uncertainty of absolute time is primarily due to uncertainty in the propagation delay of WWV. However, relative time over the course of the flight had a precession of at least 100 μsec. The observed feature was found to be most significant for very high time resolution (250 μsec), indicating a narrow pulse structure at these energies. The effect of balloon drift on the pulsar period and phase was found to be important. The flux is consistent with the spectrum of $1.0\ E^{-1.1}$ kev cm^{-2} sec^{-1} kev^{-1} observed at both lower and higher energies. (auth)

10585 (CONF-730804-P1, pp 36-40) GAMMA-RAY OBSERVATIONS AT $E_\gamma > 5 \times 10^{11}$ eV OF THE PULSARS NP 0532 AND CP 0950. Grindlay, J. E.; Helmken, H. F.; Weekes, T. C.; Fazio, G. G.; Boley, F. (Smithsonian Astrophysical Observatory, Cambridge, MA). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

At Mt. Hopkins, Arizona, a second tracking optical reflector (1.5-m aperture) has been installed 63.5 m from the 10-m (aperture) optical reflector. Pointing these two reflectors permits detection of atmospheric Cherenkov light from EAS at their mean height of electron maximum, while off-axis photomultipliers on the 10-m reflector are sensitive to the Cherenkov light from local penetrating muon cores in the showers. Previous work has shown that cosmic-ray-initiated EAS can then be rejected with >60% efficiency at primary energies $>5 \times 10^{11}$ ev. Results of ~15 hr of tracking exposure on NP 0532 and ~7 hr on CP 0950 are presented. The arrival times (within 100 μsec) of all EAS detected, as well as the nonrejected candidate gamma-ray events, have been analyzed at the pulsar periods and added together in phase. The Crab data are compared with the ~2.5-hr exposure in the 141 previous drift scans on NP 0532, obtained by the same technique, as well as with the published results from the use of a single Cherenkov detector. (auth)

10586 (CONF-730804-P1, pp 43-47) ORIGIN OF THE γ-RAY EMISSION FROM THE CRAB NEBULA AND NP 0532. Maraschi, L.; Treves, A. (CNR, Milan). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The contributions of synchrotron radiation and Compton scattering to the γ-ray flux from NP 0532 and the Crab Nebula are examined. Synchrotron radiation may explain both fluxes. Compton scattering may contribute significantly to the pulsed flux above ~100 MeV and to the continuous flux above ~1 GeV. If the variations of the continuous flux observed at 10^{11} eV are real, the synchrotron process is favored and variations should be observable also at low γ-ray energies, but not in the x-ray band. A synchrotron origin of the nebular γ-ray flux establishes conditions on electron acceleration by the pulsar. (auth)

10587 (CONF-730804-P1, pp 48-50) SEARCH FOR 10^{11}-eV PERIODIC GAMMA-RAY EMISSION FROM NP 0532. Helmken,

H. F.; Weekes, T. C.; Fazio, G. G. (Smithsonian Astrophysical Observatory, Cambridge, MA). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

With the 10-m reflector at the Mt. Hopkins Observatory, the time of arrival of Cherenkov light generated by 10^{11}-eV air showers had been used to study over 200 hr of data recorded in the direction of NP 0532. In November and December 1972, a 64-channel pulse height associated with the Cherenkov light was also recorded. It is hoped that, from the air-shower zenith angle and the Cherenkov pulse height, a better energy indication of the initiating primary can be obtained. Then, based on the NP 0532 optical period and phase, periodicity analyses with energy subdivisions can be made. (auth)

10588 (CONF-730804-P1, pp 51-54) GAMMA RAYS FROM CRAB NEBULA AND THE PULSAR NP 0532. Apparao, K. M. V.; Rengarajan, T. N. (Tata Inst. of Fundamental Research, Bombay). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Production mechanisms for the generation of ~10^{11} eV γ rays from the Crab nebula and for pulsed γ rays up to about 10^{12} eV from NP 0532 are considered. While the enhancement in the steady flux of 10^{11} eV γ rays during the spin-up periods can be accounted for in terms of Compton scattering models, it has not been possible to find any process that can explain pulsed emission at energies greater than 10^{10} eV. (auth)

10589 (CONF-730804-P1, pp 80-85) SEARCH FOR BRIEF CELESTIAL X-RAY BURSTS. Cline, T. L.; Desai, U. D. (Goddard Space Flight Center, Greenbelt, MD). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The occurrence of intense bursts of 0.1 to 1.5 MeV photons from space, discovered by Klebesadel et al., (1973), has been confirmed with observations from IMP-6. This is the first positive result of an extensive data comparison, in which OGO and IMP records were searched for time coincidences between brief x- or gamma-ray increases and a variety of other transient phenomena. Gravitational radiation events, celestial radio noise spikes, and atmospheric fluorescence increases were of particular interest, since these would also be attributed to energetic astrophysical phenomena of very short time scales. The IMP-6 measurements provided the first differential energy spectra of these events (Cline et al., 1973), the shapes of which indicate that photons predominantly in the gamma-ray domain are released into space. Whether these bursts originate in distant supernovae or in some new class of relatively nearby gamma-ray flare stars, they reveal a process which is new to high-energy astrophysics, not only because of the unusual spectrum, but also because of the brief time scales involved (<0.05 second rise times, and ≈1 second decays), and because of the intense fluxes observed (greater counting rates above 1 MeV than from a typical large solar flare). Further searches for a possible correlation between the occurrences of these gamma ray events and of other phenomena are still being made, and data from the IMP-7 satellite are still providing us with continued monitoring. New concepts in detector systems, involving wide dynamic-range time resolution, greater sensitivity and angular resolution for the energy range 0.1 to 15 MeV, are discussed. If the gamma-ray events orginate in a extended region of space such that they have a continuous size spectrum, without a cutoff too close to the presently observed frequency (several/year) and size (several hundred [>0.1 MeV] photons/cm^2), it should be possible to detect and resolve less intense and more frequently occurring bursts with balloon-borne apparatus. (auth)

10590 (CONF-730804-P1, pp 93-98) OBSERVATIONS OF LOW ENERGY HYDROGEN AND HELIUM ISOTOPES DURING SOLAR QUIET TIMES. Hurford, G. J.; Mewaldt, R. A.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A new quiet-time measurement of the relative abundance of cosmic-ray ^{2}H and ^{4}He is reported. The observations were made in selected time intervals between September 1972 and February 1973 with the Caltech Electron/Isotope Spectrometer on IMP-7. In the energy interval 13 to 29 MeV/N, an upper limit was found to the ^{2}H to ^{4}He ratio of $\Gamma(^2H/^4He) < 0.06$. This new upper limit is significantly lower than finite ^{2}H/^{4}He ratios measured in earlier years by other workers. Possible implications of this new result are discussed. (auth)

10591 (CONF-730804-P1, pp 100-105) ISOTOPIC COMPOSITION OF LOW ENERGY BERYLLIUM IN THE GALACTIC COSMIC RAYS. Garcia-Muonz, M.; Mason, G. M.; Simpson, J. A. (Univ. of Chicago). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The University of Chicago multi-element charged particle telescope on the IMP-5 satellite obtained data essentially continuously for more than three years in the interplanetary medium under stable instrument conditions which have made it possible to separate the H, He, and Be isotopes in the galactic cosmic radiation using the technique of double dE/dx vs. residual E and particle range measurements. In this paper special emphasis is placed on demonstrating that in the energy range 50 to 150 MeV/N the instrument clearly resolved ^{7}Be vs. ^{9}Be. A detailed analysis of ~100 Be events collected over the mission lifetime yields the ratios (^{7}Be/Be) = 0.50 ± 0.07, (^{9}Be/Be) = 0.41 ± 0.10 and (^{10}Be/Be) = 0.09 ± 0.10. These results are consistent with current models of galactic cosmic-ray propagation after taking account of the effects of solar modulation. (auth)

10592 (CONF-730804-P1, pp 107-110) COSMIC-RAY ISOTOPES AT ENERGIES > 2 GeV/amu. Tsao, C. H.; Shapiro, M. M.; Silberberg, R. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Most cosmic-ray nuclei of the prominent elements C, O, Ne, Mg, Si, and Fe arriving at the Earth have survived without being transformed by spallation reactions en route from the source regions. A study of the isotopic composition of these elements can provide insight into the nature and evolution of the sources. In addition, many of the arriving N, S, Ar, and Ca nuclei have originated in the source regions. Hence their isotopic abundances should also carry information about conditions at the sources. Among cosmic-ray nuclides of special interest are certain long-lived radioactive isotopes of Be, Al, Cl, and Mn, which can be used as "tracer-clocks" for estimating the dwell time of cosmic rays in the Galaxy. (auth)

10593 (CONF-730804-P1, pp 111-114) ISOTOPE MEASUREMENT ON COSMIC-RAY ALUMINIUM. Beaujean, R.; Enge, W. (Univ., Kiel). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The high resolution of cellulose nitrate plastic detectors allows to select single elements out of stopping cosmic-ray particles by a simple and quick method. The mean mass resolution based on one etch cone is 0.53 amu for particles of about 300 MeV/N in the charge region $12 \leq Z \leq 15$. A preliminary value for the mean mass of 80 Al particles is 27.0 ± 0.22. (auth)

10594 (CONF-730804-P1, pp 115-119) MEAN ISOTOPIC COMPOSITION OF COSMIC RAYS WITH $12 \leq Z \leq 26$ AT 2.7 TO 3.0 GV. Maehl, R. C.; Israel, M. H.; Klarmann, J. (Washington Univ., St. Louis). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Results are presented from a high-altitude balloon flight in Septemper 1972 near 3 GV geomagnetic cutoff. The detector is a combination of ionization chambers and a Lucite Cherenkov counter with charge resolution $\sigma = 0.34$ charge units. Following the technique described by Lund et. al. at the Hobart Conference, use was made of the geomagnetic rigidity cutoff and the measured momentum-per-nucleon spectra of individual elements to determine values of A/Z for even Z elements of $16 \leq Z \leq 26$ relative to A/Z of silicon. (auth)

10595 (CONF-730804-P1, pp 120-125) ISOTOPIC COMPOSITION OF COSMIC-RAY NUCLEI WITH $Z \geq 10$. Webber, W. R.; Lezniak, J. A.; Kish, J. (Univ. of New Hampshire, Durham). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The isotopic composition of $Z \geq 10$ cosmic-ray nuclei was recently measured using a new technique employing a combination of Cherenkov and total-energy counters. An effective mass resolution ~0.4 amu was obtained for particles of energy between 400 to 500 MeV/N with charge between 12 and 16. The preliminary mass distribution of nuclei with charge from 12 to 28 is presented and discussed. (auth)

10596 (CONF-730804-P1, pp 126-128) FLUX OF COSMIC-RAY DEUTERONS WITH RIGIDITY ABOVE 16.8 GV. Apparao, K. M. V. (Tata Inst. of Fundamental Research, Bombay). 1973.

From 13th international cosmic ray conference; Denver Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A nuclear emulsion stack exposed at a geomagnetic latitude 7.8°N was used to determine the flux of cosmic-ray deuterons with momentum above 16.8 GV. The deuterons were identified by their characteristic stripping reaction. The deuteron flux was obtained using parameters determined from a nuclear emulsion stack exposed to deuterons of momentum 9 GV, obtained from an accelerator. The flux was found to be 4 ± 1.3 M^{-2} sec^{-1} $sterad^{-1}$ which gives a deuteron/helium ratio of 22 ± 8% for rigidity greater than 16.8 GV. (auth)

10597 (CONF-730804-P1, pp 129-133) MEDIUM AND HEAVY COSMIC-RAY NUCLEI MEASURED ON BOARD OF APOLLO 16. Enge, W.; Beaujean, R.; Bartholomae, K. P.; Fukui, K. (Univ., Kiel). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

In the command module of the Apollo 16 mission a biophysical cooperation experiment, Biostack, was exposed to cosmic radiation during the 266 hours of space flight. In the part which was closest to the outside of the vehicle under about 3.5 g/cm^2 8 sheets of the cellulose nitrate plastic detector were analyzed to study the heavy cosmic-ray particles which had stopped in these sheets. In an area of 36 cm^2 about 200 tracks were evaluated. The charge spectrum of these low-energy medium and heavy nuclei (Z = 5 to 16) was determined. (auth)

10598 (CONF-730804-P1, pp 134-139) CHEMICAL COMPOSITION OF LOW ENERGY COSMIC-RAY NUCLEI OF THE ELEMENTS SILICON TO NICKEL. Behrnetz, S.; Kristiansson, K.; Lindstam, S. (Univ., Lund, Sweden). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The chemical composition of the primary cosmic radiation in the nuclear charge interval $14 \leq Z \leq 28$ was measured in two stacks of nuclear emulsions exposed in balloon flights from Fort Churchill. Particles stopping in the emulsion stacks were identified with a nuclear track photometer technique. The measured charge spectrum covers the energy interval from about 400 to about 800 MeV/N. Relative abundances are given and comparisons are made with other investigations. (auth)

10599 (CONF-730804-P1, pp 140-145) ORIGIN OF LOW-ENERGY HEAVY NUCLEI BELOW ~30 MeV PER NUCLEON OBSERVED IN INTERPLANETARY SPACE DURING QUIET TIMES, 1968-72. Mogro-Campero, A.; Schofield, N.; Simpson, J. A. (Univ., Chicago). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The nuclei B–Fe group at ~10 to 60 MeV/N was studied with the University of Chicago nuclear composition telescope on the OGO 5 satellite. It is shown that the spectra of the medium nuclei (CNO) exhibit a low-energy turn up, as has been found earlier during quiet times for H and He. The relative abundances and time variations of the low-energy nuclei are consistent with a galactic rather than a solar origin for these particles. The implications of a turn up spectrum composed of galactic particles are discussed within the framework of the solar modulation of galactic particles. (auth)

10600 (CONF-730804-P1, pp 146-151) GALACTIC HEAVY COSMIC RAYS WITH $5 < E < 130$ MeV/N. Price, P. B. (Univ. of California); Chan, J. H.; O'Sullivan, D.; Thompson, A. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1

With stacks of Lexan and cellulose triacetate exposed outside the lunar modules on Apollo 16 and 17, the spectra and composition of low-energy particles in interplanetary space were studied. For the period April 16 to 23, 1972 (Apollo 16) the spectra of the elements $6 \leq Z \leq 28$ at energies $40 \leq E \leq 150$ MeV/N were measured. For the period December 11 to 13, 1972 (Apollo 17) CNO, NeMgSi, and elements with Z > 16 at energies $5 \lesssim E \lesssim 40$ MeV/N were studied. Using the abundance of charges $17 \leq Z \leq 25$ relative to iron as a tracer, it was found that the bulk of the heavy particles in interplanetary space at E > 10 MeV/N are of galactic rather than solar origin. The relative abundances of the various charge groups are independent of energy from ~2 GeV/N down to ~30 MeV/N. (auth)

10601 (CONF-730804-P1, pp 152-156) HIGH CHARGE RESOLUTION OF COSMIC-RAY PARTICLES (Z = 24–28) APPLYING ULTRAVIOLET IRRADIATION. Bartholomae, K. P.; Enge, W.; Siegmon, G.; Beaujean, R. (Institut fuer Reine Kernphysik, Kiel). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

For the enhancement of charge and mass resolution of Lexan polycarbonate plastic ultraviolet irradiation was used. 2000 cm^2 of plastic was irradiated with uv in one run with a homogeneity of irradiation of about 1.5%. An increase of charge resolution by a factor of three was measured. For Z = 26 a charge resolution of 0.1 charge units and a mass separation of 1.0 amu were measured. The analysis was based upon measurements in a stack of 18 Lexan sheets, which was flown at an altitude of 1.8 g/cm^2 for 10 hours from Ft. Churchill. (auth)

10602 (CONF-730804-P1, pp 157-162) VARIATIONS OF THE CARBON + OXYGEN TO IRON AND THE PRIMARY TO SECONDARY RATIOS WITH ENERGY FROM 2 TO 50 GeV/N. Ormes, J. F.; Balasubrahmanyan, V. K.; Arens, J. F. (Goddard Space Flight Center, Greenbelt, MD). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

New data on the differential energy distribution of heavy nuclei in the galactic radiation indicate that the cosmic-ray charge composition is energy dependent. The data were obtained on a balloon flight of a 5,000 lb. ionization spectrometer and cover the energy range from the geomagnetic cutoff at 1.5 GeV/N to more than 50 GeV/N. Complex couplings between the energy measurement, the charge determination, and the background subtraction have been understood and will be discussed. A striking difference between the spectrum of iron and carbon + oxygen of 0.56 ± 0.14 of a power has been found. This difference is much larger than the observed difference between the spectra of primary and secondary nuclei, $\Delta\gamma = 0.21 \pm 0.09$. If this difference holds to higher energy, iron nuclei will become as abundant as carbon + oxygen at a few hundred GeV/N. The difference between primary spectra probably cannot be understood in terms of propagation as we understand from contemporary composition data. New experiments to differentiate between charge dependent acceleration, a separate cosmic-ray source for iron nuclei, and an extreme propagation model are discussed. (auth)

10603 (CONF-730804-P1, pp 163-165) INTERPRETATION OF THE CARBON–OXYGEN TO IRON RATIO. Balasubrahmanyan, V. K.; Ormes, J. F.; Ramaty, R. (Goddard Space Flight Center, Greenbelt, MD). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Data from recent measurements on the composition of primary cosmic rays above 1 GeV/N is critically reviewed for information pertaining to selection of suitable energy dependent composition models. Areas where crucial experimental information may result in selection of a suitable model are pointed out. In particular, the study of energy distribution of V.V.H. nuclei, and obtaining more accurate energy spectra of $10 \leq Z \leq 14$, $15 \leq Z \leq 23$, and Z > 24 would contribute to a discrimination between models which rely on interstellar propagation and those that ascribe a different source mechanism for Fe group nuclei. (auth)

10604 (CONF-730804-P1, pp 166-170) CHEMICAL ABUNDANCES OF COSMIC RAYS > 4.5 GV MEASURED WITH A LARGE AREA PROPORTIONAL COUNTER-SCINTILLIATION COUNTER STACK. L'Heureux, J. (Univ. of Arizona, Tucson); Fan, C. Y.; Gloeckler, G.; Mainardi, R. (Univ. of Arizona, Tucson). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A 6500 cm^2-ster cosmic-ray detector consisting of twelve gas counter trays sandwiched between two large area circular scintillation counters was flown from Palestine, Texas in November of 1972 to study the composition of primary particles > 1.5 GeV/N in the charge range 3 to 30. For each analyzed event, i) the particle trajectory using four 20 wire proportional counter trays, ii) the energy loss in each of the solid counters, and iii) the dE/dx losses in each of the twelve gas counters were recorded. The large dynamic range of the detector is established by operating six of the gas counters in the ionization mode. A description of the instrument and some preliminary results are given. (auth)

10605 (CONF-730804-P1, pp 171-176) CHARGE SPECTRUM OF VH NUCLEI RECORDED AT A VERTICAL CUT-OFF RIGIDITY OF 11.5 GV. Kidd, J. M.; Wefel, J. P. (Lab. for Cosmic Ray Physics, Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Four nuclear emulsion stacks, each 1200 cm^2 in area, were flown from Parana, Argentina (R_{vert} = 11.5 GV) at an atmospheric depth of 2.5 g/cm^2 for ~7 hours. Approximately 16% of the detector area has been scanned for tracks produced by VH nuclei. The rate of energy loss of each particle was subsequently measured on a double slit photodensitometer. The high geomagnetic rigidity threshold, and consequently the small uncertainty in particle velocity, allowed the charge to be determined from the photometric measurements. From the analysis of 200 tracks it was found that the ratio $(23 \leq Z \leq 24)/(25 \leq Z \leq 27) = 0.23 \pm 0.05$ and the ratio $(28 \leq Z \leq 29)/(25 \leq Z \leq 27) = 0.06 \pm 0.02$. The experimental techniques and the charge resolution are also discussed. (auth)

10606 (CONF-730804-P1, pp 178-183) COSMIC-RAY NUCLEAR COMPOSITION ABOVE 20 GeV/N. Juliusson, E. (Univ. of Chicago). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

In three balloon flights during 1971 and 1972 a scintillator-Cherenkov counter telescope to measure the charge composition of cosmic-ray nuclei was exposed for a net total of 7.6 m^2 sr hours. The telescope included two gas Cherenkov counters for energy measurements above 20 GeV/N. In this energy range about 3400 nuclei between Li and Fe were detected and analyzed. The resulting charge composition and energy spectra are presented. The nuclear composition was found to change with energy. The flux of galactic daughter nuclei decreases faster with increasing energy than the flux of source nuclei. The carbon/oxygen abundance ratio is significantly reduced as compared to low-energy measurements, and iron seems to exhibit a flatter energy spectrum than other nuclei. (auth)

10607 (CONF-730804-P1, pp 184-188) DETERMINATION OF THE FLUXES OF MEDIUM AND HEAVY NUCLEI AT RIGIDITIES GREATER THAN 13 GV. Anand, K. C.; Rengarajan, T. N.; Stephens, S. A. (Tata Inst. of Fundamental Research, Bombay). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

From a study of about 600 nuclei recorded in a nuclear emulsion stack flown over Hyderabad, the integral fluxes of groups of nuclei M($6 \leq Z \leq 8$) H1($10 \leq Z \leq 16$) and VH ($Z \geq 20$) above a rigidity of 16.9 GV were found to be (0.59 ± 0.033), (0.21 ± 0.02), and (0.043 ± 0.009) nuclei/(m^2 sec sr), respectively. Since the stack was oriented in the east–west plane, ratios of integral fluxes of these groups of nuclei were also obtained at different rigidities by making use of the variation of cut-off rigidity with zenith angle. (auth)

10608 (CONF-730804-P1, pp 189-194) INTERPRETATION OF THE CHEMICAL COMPOSITION OF HIGH-ENERGY COSMIC RAYS. Cesarsky, C. J.; Audouze, J. (California Inst. of Tech., Pasadena). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

An analysis of recent results (Juliusson et al., Webber et al., Ormes et al., Smith et al.) on the composition of high-energy galactic cosmic rays (5 to 100 GeV/N) was made. Conclusions regarding the diffusion of cosmic rays in the Galaxy and the composition of cosmic rays in the sources are presented. (auth)

10609 (CONF-730804-P1, pp 195-199) COMPOSITION OF $Z \geq 5$ NUCLEI AT 1.3 GeV/N AND 23 GeV/N. Badhwar, G. D. (Johnson Space Center, Houston, TX); Osborn, R. W. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Measurements made with a balloon-borne counter telescope having an exposure factor of 842 m^2 sr. sec. are reported. The telescope was flown from Palestine, Texas, during the fall of 1971 for a total of 10 hours under an average residual atmospheric depth of 4.5 g/cm^2. The analysis indicates that the integral flux ratios above 1.3 GeV/N and 23 GeV/N are consistent with energy independence. (auth)

10610 (CONF-730804-P1, pp 202-207) COSMIC-RAY COMPOSITION AT > 10^{12}eV FROM MUON/ELECTRON RATIOS IN EAS. Grindlay, J. E.; Helmken, H. F. (Smithsonian Astrophysical Observatory, Cambridge, MA). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The relative distribution of atmospheric Cherenkov light from the EAS maximum (electrons) and penetrating cores (muons) in ~2000 EAS at $E > 1 \times 10^{12}$ eV are presented. These data were acquired with the Cherenkov telescope array at Mt. Hopkins, Arizona, and represent a factor of ~10 increase in sample size over similar data presented at the Hobart Conference. The distribution of pulse height ratios, proportional to the muon/electron ratio in EAS, are compared with theoretical distributions from new Monte Carlo simulations of $\geq 10^{12}$ eV EAS initiated by two trial chemical abundance distributions, including the low-energy abundance. The implications of the data for the chemical abundance in the energy range $10^{12} \leq E_0 \leq 10^{13}$ eV are discussed. (auth)

10611 (CONF-730804-P1, pp 208-212) COSMIC-RAY COMPOSITION MEASUREMENTS AT HIGH ENERGIES. Ataliah, K.; Cleghorn, T. F.; Modlinger, A.; Schmidt, W. K. H. (Max-Planck-Institut fuer Extraterrestriche Physik, Garching). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

An ionization spectrometer consisting of a lead-scintillator sandwich was used to detect primary cosmic rays at balloon altitudes. Added to the ionization spectrometer were a five gap spark chamber for trajectory determination together with a Cherenkov counter and a scintillator for charge measurement. The instrument was flown in October, 1972, from Palestine, Texas. Preliminary results of that flight are presented. (auth)

10612 (CONF-730804-P1, pp 213-218) PRIMARY SPECTRUM AND COMPOSITION IN THE REGION 10×1000 TeV. Elbert, J. W.; Keuffel, J. W.; Lowe, G. H.; Morrison, J. L. (Univ. of Utah, Salt Lake City). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The spectra and composition of cosmic-ray primaries are being studied by fitting extensive and detailed underground muon data using scaling model calculations of hadronic interactions in the atmosphere. Three types of data have been analyzed: (1) The intensity-depth curve for the total flux of muons. (2) The muon charge ratio. (3) The rates of doubles, triples, and higher multiplicities in the standard 80 m^2 fiducial area of the Utah detector. Several constraints on the primary spectra and composition are obtained by considering these data and implications for some proposed spectra and compositions are discussed. (auth)

10613 (CONF-730804-P1, pp 219-224) PRIMARY COSMIC-RAY SPECTRUM FROM 2×10^{11} EV TO 10^{15} EV. Gerdes, C. (Univ. of Arizona, Tucson); Fan, C. Y.; Weeks, T. C. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

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The differential energy spectrum of primary cosmic rays of energies between 2×10^{11} eV and 10^{15} eV was measured. This was done by detecting and analyzing the atmospheric Cherenkov radiation excited by extensive air shower particles produced by the interactions of the energetic primary cosmic ray and air molecules. The apparatus used for the detection was the 10 m reflector and two 1.5 m mirrors of the Smithsonian Astrophysical Observatory at Mt. Hopkins. The dynamic range of the associated electronics was increased by the use of a fast amplifier with logarithmic response. (auth)

10614 (CONF-730804-P1, pp 225-230) SEARCH FOR ANTINUCLEI IN THE PRIMARY COSMIC RAYS. Smoot, G. F.; Buffington, A.; Orth, C. D.; Smith, L. H. (Univ. of California, Berkeley). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The search was continued for primary cosmic-ray antinuclei with charges $2 \leq Z \leq 26$ and with rigidities above 5 GV/c using a second-generation superconducting magnetic spectrometer with an average bending power of 5.1 kilogauss-meters. The addition of these new data doubles the sample of cosmic-ray nuclei previously reported and greatly increases the percentage of the more highly charged nuclei. (auth)

10615 (CONF-730804-P1, pp 232-237) ABUNDANCES RELATIVE TO CARBON OF THE ELEMENTS SILICON TO NICKEL IN THE GALACTIC COSMIC RADIATION. Cartwright, B.; Garcia-Munoz, M.; Simpson, J. A. (Univ. of Chicago). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1

The abundances relative to carbon of the elements from silicon to nickel in the galactic cosmic radiation are reported as measured by the University of Chicago cosmic-ray telescopes on the IMP-5 and IMP-7 satellites, in energy ranges between 40 and 450 MeV/N depending on the species. The IMP-7 measurements are still to be

considered only preliminary and do not yet fully exploit the resolution capabilities of that instrument. Calculations of the abundances to be expected in this charge range if the cosmic radiation traverses 6 g/cm^2 of material after acceleration are presented, and the consequences which follow both for propagation models and for the chemical composition of the sources of the cosmic radiation are discussed. (WDM)

10616 (CONF-730804-P1, pp 238-243) NUCLEAR SPECTROMETER TO DETERMINE PRIMARY COSMIC-RAY FLUX AS A FUNCTION OF CHARGE. Julliot, C.; Cantin, M.; Engelmann, J.; Koch, L.; Petrou, N.; Soutoul, A. (CEN de Saclay, Gif-sur-Yvette, France). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

In March 1972 a cosmic-ray telescope was launched on the first astronomical ESRO satellite TD1. This telescope was designed to study the elemental composition of $2 \leq Z \leq 28$ nuclei for energies ≥200 MeV/N using a combination of energy-loss measurements in silicon detectors and Cherenkov yield in a sapphire counter. The absolute flux of M nuclei above 1 GeV/N are given. The abundances relative to oxygen of $5 \leq Z \leq 14$ nuclei and the relative abundance to iron of $16 \leq Z \leq 28$ nuclei in the same energy range are also given. (auth)

10617 (CONF-730804-P1, pp 244-247) COSMIC-RAY NUCLEI OF NEON TO NICKEL: SOURCE COMPOSITION AND PROPAGATION. Chohan, V. S. (Panjab Univ., Chandigarh, India); Bhatia, V. S.; Pabbi, S. D.; Biswas, S. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The charge composition and energy spectrum of about 500 cosmic-ray nuclei of neon to nickel were measured in 250 to 1000-MeV/N energy interval in two emulsion stacks flown in balloons from Ft. Churchill. In order to understand the observed relative abundances in terms of source composition and interstellar propagation, calculations were made on the relevant spallation cross sections and the expected relative abundances of (Ne−Si), (S−K), (Ca−Ti), (V−Mn), and Fe near the Earth are obtained in three energy intervals, 150, 500, and ≥1500 MeV/N assuming the distribution of path lengths in gaussian and in exponential forms. On comparing the calculated values with observed ones in this and other works, it is found that observed abundances can be understood in terms of source composition as Fe : Ca : S : Si : Mg : Ne = 100 : 20 : 10 : 80 : 100 : 80 and a gaussian distribution of path lengths with a mean value of 4.5 g cm^{-2} of hydrogen. In the high-energy interval the observed data are in disagreement with a pure exponential distribution of path lengths with a leakage path length as 7 g cm^{-2}. This implies a dearth of short path lengths for cosmic-ray nuclei. (auth)

10618 (CONF-730804-P1, pp 248-253) DIFFERENCES IN THE SPECTRA OF COSMIC-RAY NUCLEAR SPECIES BELOW ~5 GeV/N. Webber, W. R.; Lezniak, J. A.; Kish, J. (Univ. of New Hampshire, Durham). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Previous measurements made at high energies and which show clear evidence for energy dependent changes in cosmic-ray composition were extended to lower energies. This new data points to the fact that these spectral differences extend over the entire energy band from a few hundred MeV/N to several 10's of GeV/N. The details of these composition variations are examined by studying in a systematic way the variations of the ratios of secondary to primary and different groups of primary cosmic-ray nuclei. (auth)

10619 (CONF-730804-P1, pp 255-259) ENERGY SPECTRA OF INDIVIDUAL COSMIC-RAY ELEMENTS WITH $12 < Z \leq 28$. Israel, M. H. (Washington Univ., St. Louis); Klarmann, J.; Maehl, R. C.; Binns, W. R. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Results are presented from a high-altitude balloon flight in September 1972 of a detector using ionization chambers and a lucite Cherenkov counter. Relative abundances of elements of $14 \leq Z \leq 30$ are presented as are energy spectra for individual elements between 0.8 and 1.6 GeV/N. A difference between the low and high-energy relative abundances of iron and iron-secondaries was found along with a sharp fall-off in the Fe/Si ratio below 1 GeV/N. (auth)

10620 (CONF-730804-P1, pp 260-264) CHEMICAL COMPOSITION OF COSMIC RAYS WITH $Z \geq 30$ AND $E \geq 325$ MeV/N. Binns, W. R. (Washington Univ., St. Louis); Fernandez, J. I.; Israel, M. H.; Klarmann, J.; Maehl, R. C.; Mewaldt, R. A. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Results are presented on the chemical composition of VVH cosmic rays from a series of six high-altitude balloon flights of a large-area, high-resolution electronic detector. The charge composition in the $32 \leq Z \leq 45$ interval was found to be inconsistent with S-process nucleosynthesis. The energy spectrum of particles with $Z \geq 32$ between 600 and 1500 MeV/N at the top of the atmosphere was measured and found to be consistent with the $25 \leq Z \leq 27$ group within experimental error. (auth)

10621 (CONF-730804-P1, pp 265-269) PRIMARY COSMIC-RAY PARTICLES WITH $Z > 35$ (VVH PARTICLES). Blanford, G. E. Jr.; Friedlandler, M. W.; Hoppe, M.; Klarmann, J.; Walker, R. M.; Wefel, J. P. (Washington Univ., St. Louis). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Large areas of nuclear emulsions and plastic detectors were exposed to the primary cosmic radiation during high-altitude balloon flights. From the analysis of 141 particle tracks recorded during a total exposure of 1.3×10^7 m^2.ster.sec., a charge spectrum of the VVH particles was derived. (auth)

10622 (CONF-730804-P1, pp 270-274) TESTING OF MODELS OF VVH PARTICLE SOURCES AND PROPAGATION. Blanford, G. E. Jr.; Friedlander, M. W.; Hoppe, M.; Klarmann, J.; Walker, R. M.; Wefel, J. P. (Washington Univ., St. Louis). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

For comparisons between theoretical and observed charge spectra of the VVH particles to be meaningful, at least two conditions must be met. First, charge resolution must be adequate to separate important groups of nuclei, and there should be no significant systematic errors in the charge scale developed. Interactions of VVH particles observed give confidence in the charge scales. Second, there must be adequate rejection of slower particles of smaller Z, which have been observed in several flights. Within these conditions, it has been shown that observed features of the charge spectrum are not accidents of the analysis but reflect real variations in the relative abundances that must be explained by any successful model. (auth)

10623 (CONF-730804-P1, pp 275-279) ORIGIN AND PROPAGATION OF VVH PRIMARY COSMIC-RAY PARTICLES. Blanford, G. E. Jr.; Friedlander, M. W.; Klarmann, J.; Walker, R. M.; Wefel, J. P. (Washington Univ., St. Louis). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

In an attempt to match the observed charge spectrum of VVH particles, several source spectra were constructed from combinations of R- and S-process nuclei. Their propagation was then followed, allowing for interactions and decay, and comparisons were made between the calculated near-Earth spectra and those observed during high-altitude balloon flights. None of the models yet used leads to good agreement with observation, suggesting either that more complicated models need to be examined, or that different components (for instance the R- and S-process nuclei) have different histories. (auth)

10624 (CONF-730804-P1, pp 281-286) KINETIC ENERGY SPECTRA OF 5 TO 1500-MeV/N VH NUCLEI LONG-TERM AVERAGED FLUX AT 1 TO 3 AU. Bhandari, N. (Physical Research Lab., Ahmedabad, India); Goswami, J. N.; Lal, D. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A detailed study of the depth dependence of fossil tracks induced by the VH group of nuclei ($Z > 20$) in meteoritic and lunar samples was carried out to evaluate the long term (millions of years) averaged fluxes of these nuclei over the energy interval 5 to 1500 MeV/N. The flux in the energy region below 500 MeV/N is primarily based on analyses of lunar samples having the simplest irradiation history. The results for the energy interval 500 to 1500 MeV/N are based on meteoritic data. Corrections necessary to take into account the effect of erosion and/or ablation were explicitly considered. Absolute flux for $E < 500$ MeV/N is based on suitable normalization of the data (lunar) to the contemporary cosmic ray and meteoritic fossil track based flux at 500 MeV/N. The lunar and meteoritic data are consistent in the overlapping energy region. Based on the observed spectral shape, it is tempting to identify the time-averaged low-energy VH-nuclei

flux below 10 MeV/N with the Sun. The deduced erosion controlled mean irradiation periods for E ≤ 10 MeV/N are in the range of 10^4 to 10^5 yrs. At higher energies, E ≥ 100 MeV/N, the time averages correspond to periods of a million year to a few tens of million years. A comparison with the contemporary flux of VH-nuclei observed during the last solar cycle indicates that the flux of high-energy (E > 100 MeV/N) galactic VH nuclei has certainly remained the same within a factor of two during the last tens of million years. A similar comparison is made for low-energy solar particles. (auth)

10625 (CONF-730804-P1, pp 287-292) TEMPORAL VARIATIONS IN THE RELATIVE ABUNDANCES OF GALACTIC VH AND VVH NUCLEI DURING LAST 0.1 B.Y. Bhandari, N. (Physical Research Lab., Ahmedabad, India); Lal, D.; Tamhane, A. S. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The relative abundances of VVH (Z > 30) and VH (Z > 20) nuclei of 20 to 200 MeV/N at 1 AU, during different periods of time extending to the past 0.1 B.Y., were determined from a study of the fossil track in olivine crystals selected from meteorites, Apollo rocks, and the stratified lunar soil cores. The two lunar cores examined, 12025, 28, and 15001-6 contain 11 and 42 layers respectively; the two samples reported on acquired most of their tracks in exposures lasting for a duration of 10^5 to 10^7 years, 10^8 years ago, as determined using the fossil track method. This "differential" type of information of VVH/VH nuclei is compared with the "integral" type for two lunar surface rocks of exposure age <3 m.y. and three meteorites of 50 to 60 m.y. exposure age. Thus lunar rocks and meteorites provided information on the spatial variation of VVH/VH nuclei in the solar system at 1 to 3 AU during the last 3 to 60 m.y. The present study includes the track-rich grains of the meteorite Staroe Pesaynoe, representing short irradiation periods of 10^4-10^5 yrs. Although the time of irradiation of these grains is not known, it may predate the formation of meteoritic parent bodies, i.e., ~4.5 B.Y. The results indicate a rather small variation in the ρ_{VVH}/ρ_{VH} ratios: the range is 0.9 to 2×10^{-3}. It seems interesting to explore the possibility of studying individual sources from a careful shorter interval "differential" type of information discussed. (auth)

10626 (CONF-730804-P1, pp 293-301) FIRST RESULTS ON GAMMA-RAY OBSERVATIONS FROM THE ESRO TD-1A SATELLITE. Voges, W. (Max-Planck-Institut fuer extraterrestrische Physik, Garching, Ger.); Pinkau, K.; Koechlin, Y.; Leray, J. P.; Boella, G.; Sironi, G.; Turner, M. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Experiment S-133 has been recording celestial gamma rays from an all-sky scan during the period March–October 1972. This fully operational spark chamber experiment that can record electron pairs from converted gamma rays has a geometry factor of about 16 cm^2 ster, and an asymptotic efficiency of about 20% above 150 MeV. It starts to record gamma rays above about 20 MeV. The sky coverage, averaged over the months of operation, has been about 50%. Sky maps of γ rays are presented and discussed. (auth)

10627 (CONF-730804-P1, pp 302-310) OBSERVATION OF CELESTIAL HIGH-ENERGY GAMMA RAYS FROM SAS-II. Fichtel, C. E.; Hartman, R. C.; Kniffen, D. A. (Goddard Space Flight Center, Greenbelt, MD). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The Small Astronomy Satellite (SAS)-II, launched on November 15, 1973 carried into orbit a 32-deck magnetic-core digitized spark chamber gamma-ray telescope to study celestial gamma radiation in the energy range above 30 MeV. At the time of the writing of this paper, May 21, 1973, SAS-II had viewed approximately half the sky including the galactic center region, the galactic anticenter, and several regions off the galactic plane, and about one-third of the data from eight weeks of viewing has been analyzed. A finite diffuse flux for regions with $|b_{II}| > 20°$ has been detected with a very steep energy spectrum. Combining this result with low energy gamma-ray data yields a picture suggesting a cosmological origin for this radiation. The enhanced flux from the galactic center region observed by OSO-III has been confirmed. The enhanced region extends for 60° to 70° along the galactic plane. Whereas the average energy spectrum from the galactic center region is much harder than the diffuse radiation, the number of gamma rays between 40 and 70 MeV relative to the number above 100 MeV is inconsistent with a pure π^0 decay spectrum. (auth)

10628 (CONF-730804-P1, pp 313-316) MEASUREMENT OF COSMIC-RAY POSITRON AND NEGATRON SPECTRA BETWEEN 50 AND 800 MeV. Daugherty, J. K.; Hartman, R. C.; Schmidt, P. J. (Goddard Space Flight Center, Greenbelt, MD). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A magnetic spectrometer employing digital-readout spark chambers and a gas Cherenkov threshold counter was used to measure the spectra of cosmic-ray negatrons and positrons over the range 50 to 800 MeV during two balloon flights from Ft. Churchill, Manitoba, in July 1972. A preliminary analysis of data from the first flight suggests that the total electron spectrum in this range has not fully recovered to its condition at solar minimum observed in 1965. The preliminary results also provide upper limits for the positive fraction over the range 200 to 800 MeV which are consistent with the values found in earlier measurements. (auth)

10629 (CONF-730804-P1, pp 318-323) MEASUREMENT OF SEPARATE ELECTRON AND POSITRON SPECTRA IN THE PRIMARY COSMIC RAYS FROM 5 to 50 GeV. Buffington, A.; Smoot, G. F.; Smith, L. H.; Orth, C. D. (Univ. of California, Berkeley). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A magnetic spectrometer and lead-plate spark chamber were used to measure separate primary cosmic-ray electrons and positrons up to 50 GeV. Separation of these particles from the background was accomplished with a new technique combining both selective trigger and observation, in the lead-plate chamber, of bremsstrahlung photons that were carried in a thin radiator placed above the spectrometer. The results of efficiency and rejection calibrations with accelerator tests and Monte Carlo calculations are presented along with preliminary data from a balloon-flight exposure of the apparatus. (auth)

10630 (CONF-730804-P1, pp 324-329) ENERGY SPECTRUM OF 0.16 to 3 MeV ELECTRONS DURING SOLAR QUIET TIMES. Hurford, G. J.; Mewaldt, R. A.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

New observations of the quiet-time energy spectrum of 0.16 to 3 MeV electrons have been made with the Caltech Electron/Isotope Spectrometer which was launched on IMP-7 in September 1972. Recent measurements of quiet-time electrons in this energy range by other groups have resulted in spectra differing by more than an order of magnitude in intensity. A minimum quiet-time flux level similar to the lowest previously reported spectra and consistent with an extrapolation of the spectrum measured at higher energies was found. A galactic secondary source of knock-on electrons is consistent with the results provided that there is negligible solar modulation. Although not required, other recently suggested sources may also contribute to the observed fluxes. (auth)

10631 (CONF-730804-P1, pp 330-334) OBSERVATIONS OF THE RATIO OF LOW-ENERGY COSMIC-RAY POSITRONS AND ELECTRONS DURING SOLAR QUIET TIMES. Hurford, G. J.; Mewaldt, R. A.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Simultaneous observations of the quiet-time interplanetary positron and electron spectra between 0.16 and 1.6 MeV are reported. The measurements were made in selected time intervals between October,1, 1972 and February 1, 1973 with the Caltech Electron/Isotope Spectrometer on the IMP-7 satellite. The detector system consists of a stack of 11 silicon surface-barrier detectors surrounded by a plastic scintillator anti-coincidence cup. The method of e^+ identification and possible background effects are discussed and upper limits to the 0.16 to 1.6 MeV quiet-time positron flux are reported. During this period positrons amounted to less than 20% of the total 0.16 to 1.6 MeV electron flux. (auth)

10632 (CONF-730804-P1, pp 335-339) INTERSTELLAR ELECTRON SPECTRUM FROM THE GALACTIC NON THERMAL RADIO EMISSION. Cummings, A. C.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena). 1973.

In 13th international cosmic ray conference. Vol. 1.

A range of interstellar electron spectra at energies between 100 MeV and 5 GeV was derived from an analysis of the observed galactic nonthermal radio spectrum and from consideration of the existing uncertainties in the other relevant physical parameters of

the Galaxy. It was found that for energies larger than ~300 MeV the electron spectrum is uncertain to a factor of 4 due to uncertainties in the galactic magnetic field strength and the total line-of-sight emission length. The uncertainty in the electron spectrum increases towards lower energies, exceeding a factor of 50 near 100 MeV, primarily due to uncertainties in the galactic parameters affecting interstellar radio absorption. (auth)

10633 (CONF-730804-P1, pp 340-345) EVIDENCE FOR PRIMARY INTERSTELLAR COSMIC-RAY ELECTRONS. Cummings, A. C.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A comparative study was made of the absolute solar modulation of cosmic-ray positrons (e^+) and electrons ($e^+ + e^-$). It was found that the interstellar electron spectrum, which is described by a power-law slope at higher energies, must flatten below ~100 MeV, that a significant fraction of interstellar cosmic-ray electrons must originate in "primary" sources, and that the rigidity dependence of the interplanetary cosmic-ray diffusion coefficient, R^{α}, changes from $\alpha > 0$ at higher rigidities to $\alpha \approx -1$ below ~60 MV. (auth)

10634 (CONF-730804-P1, pp 347-352) SHAPE OF THE PRIMARY COSMIC-RAY ELECTRON SPECTRUM ABOVE 10 GeV. Silverberg, R. F.; Ormes, J. F.; Balasubrahmanyan, V. K. (Goddard Space Flight Center, Greenbelt, MD). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A balloon-borne measurement of the cosmic-ray electron spectrum above 10 GeV is reported in which two new techniques were used to remove proton background contamination. First, the depth of the spectrometer on one of the flights was more than 40 radiation lengths, the equivalent of more than 3 mean free paths of material, enabling hadronically and electromagnetically induced cascades to be differentiated for a subset of the data. Second, electromagnetic cascade starting points were determined to within about ±0.1 radiation lengths based upon a calibration with electrons from 5.4 to 18 GeV at the Stanford Linear Accelerator, greatly reducing the chances for a proton to simulate an electron. The resulting spectrum, when fitted with a power law, is steep, -3.2 ± 0.1, but the fit is marginal. A significantly better fit is achieved by assuming a model in which the spectrum is steepening in the measured region. (auth)

10635 (CONF-730804-P1, pp 355-360) FINAL RESULTS ON THE TIFR COSMIC-RAY ELECTRON SPECTRUM IN THE REGION 10 to 800 GeV. Anand, K. C.; Daniel, R. R.; Stephens, S. A. (Tata Inst. of Fundamental Research, Bombay). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Preliminary results from an experiment carried out to determine the energy spectrum of high-energy cosmic-ray electrons using a large lead-emulsion sandwich stack, based on 51 electrons of energy greater than 150 GeV were reported at the Hobart Conference. The final data reduction and analysis have now been completed for 86 electrons of energy greater than 50 GeV. Earlier experiments from this group using pure emulsion blocks have yielded results between 10 and 200 GeV; these observations obtained using different scanning and energy determination procedure are in good agreement with one another and those from the present experiment. The results are therefore combined to yield a spectrum from about 10 GeV to 800 GeV using a total of 177 electrons. (auth)

10636 (CONF-730804-P1, pp 361-366) MEASUREMENTS OF THE SPECTRUM OF GALACTIC ELECTRONS AT VERY HIGH ENERGIES. Mueller, D. (Univ. of Chicago). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A counter telescope was exposed in three balloon flights in 1970 to measure the flux and energy spectrum of cosmic-ray electrons between 10 and 1000 GeV. This instrument has been modified by incorporating a large area CsI crystal as well as highly efficient time of flight circuitry, and was flown again twice during 1972. The methods of data analysis are based on extensive accelerator calibrations at SLAC. The resulting electron spectrum fits well to a single power law with index $\gamma = 2.66$ over the whole energy region. No obvious steepening can be observed, although statistical uncertainties prohibit definite claims beyond ~250 GeV. (auth)

10637 (CONF-730804-P1, pp 368-372) SUPERHEAVY COSMIC RAYS AND THE FLUCTUATING INTERSTELLAR DENSITY. Wayland, J. R. (Texas A and M Univ., College Station). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The effects of a fluctuating interstellar density on the measured flux of cosmic-ray particles with $A > 81$ are examined within the framework of stochastic processes. The model is one in which the sources and the interstellar clouds occur with a random distribution within the Galaxy. Formulae are presented for the moments of the probability distribution function of the observed flux. The dispersion to be expected in measurements of the flux is given as a function of the characteristics of the interstellar medium. (auth)

10638 (CONF-730804-P1, pp 373-377) COSMIC RAYS AT VERY HIGH ENERGIES: DISCUSSION OF SOME NEW RESULTS. Juliusson, E.; Meyer, P.; Mueller, D. (Univ. of Chicago). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Recent measurements of the nuclear cosmic-ray composition up to 100 GeV/N and of the spectrum of cosmic-ray electrons to almost 1000 GeV have provided new evidence relevant to the origin of these particles and to their propagation in the interstellar medium. It was shown that the abundance of galactic daughter nuclei decreases with increasing energy relative to the abundance of parent nuclei. It was also found that the energy spectrum of electrons is consistent with a single power law up to 1000 GeV without much steepening. These results are possibly related and they are discussed in terms of (a) a relatively local origin of energetic cosmic rays, (b) an extragalactic origin of the cosmic radiation, and (c) an energy dependent confinement of galactic cosmic rays. (auth)

10639 (CONF-730804-P1, pp 378-383) VARIATION OF THE HIGH-ENERGY PRIMARY NUCLEI COMPOSITION AND THE CONFINEMENT REGION OF COSMIC RAYS. Meneguzzi, M. (CEN de Saclay, Gif sur Yvette, France). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Using the recent measurements of cosmic-ray chemical composition between 10 and 100 GeV/N, it is shown that if the very high-energy (10^{12} to 10^{15} eV) spectral index of 2.7 is believed to be the source spectral index, the observed variation of the primary nuclei abundances with energy is difficult to reconcile with a galactic origin and confinement with a mean escape length from the Galaxy of $\simeq 7$ g/cm^2. The observations can be explained if the mean path length of cosmic rays ($\simeq 7$ g/cm^2) represents the escape length from galactic sources, or if cosmic rays are of extragalactic origin. (auth)

10640 (CONF-730804-P1, pp 384-389) ATTEMPT TO UNDERSTAND THE CHANGES IN COSMIC-RAY COMPOSITION AT MEDIUM ENERGIES. Rengarajan, T. N.; Stephens, S. A.; Verma, R. P. (Tata Inst. of Fundamental Research, Bombay). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Present observations on cosmic-ray nuclei show that the energy spectrum of nuclei of secondary origin is steeper than that of the primary nuclei and the energy spectrum of iron group of nuclei is flatter than that of other nuclei. An attempt is made to show that these observations can be understood on the basis of propagation effects in the two component model of interstellar medium, without invoking any change in the residence time of cosmic rays in the Galaxy. The available data on iron nuclei are examined to bring out some of the anomalies both in the observations and in the theoretical explanations so far given. (auth)

10641 (CONF-730804-P1, pp 390-395) INTERPRETATION OF THE SHAPE OF THE PRIMARY SPECTRUM NEAR 10^{15} eV. Bell, M. C.; Kota, J.; Wolfendale, A. W. (Univ. of Durham, Eng.). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

An examination was made of the diffusion of cosmic rays in the presence of clouds of neutral hydrogen containing magnetic fields. It was concluded that a model having clouds alone cannot explain the observations but if a near uniform magnetic field of ~1.5 μ gauss is superimposed it is possible to explain the shape of the primary spectrum to about 10^{17} eV. At higher energies it is necessary to postulate extragalactic origin. (auth)

10642 (CONF-730804-P1, pp 396-401) ANISOTROPY AND ENERGY SPECTRUM OF COSMIC RAYS IN INTERSTELLAR SPACE. Aitmuhambetov, A. A.; Alentiev, A. N.; Zusmanovich, A. G.; Kolomeets, E. V. (Kazakh State Univ., Alma-Ata, USSR). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The results of a study of the energy spectrum of galactic cosmic rays with energies above 100 MeV in the interstellar space and of sidereal cosmic-ray anisotropy in the energy range ~10^{11} eV are presented. It is shown that energy spectra of all charge groups have the same form. The energy density of cosmic rays and the energy flux are found to be 2.4eV · cm^{-3} and ~2.10^3 MeV · cm^{-2} · $sterad^{-1}$ · sec^{-1}, respectively. The amplitude of anisotropy is 0.04% and maximum anisotropy is observed at 19 h of local sidereal time. (auth)

10643 (CONF-730804-P1, pp 422-425) STOPPING POWER OF THE GALACTIC H II-REGIONS FOR CHARGED COSMIC-RAY PARTICLES. Bagge, E. R. (Univ., Kiel). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

There is a big difference between the stopping power for high-energy charged particles by a gas of neutral atoms and molecules and by a highly ionized gas with the same numbers of nuclei and electrons per cm^3 in it. This effect originally recognized by Bunemann (1959) was interpreted as produced by the excitation of plasma waves in the highly ionized medium, which gives an additional stopping power to the normal energy transfer of high energy particles to other particles in passing the medium. It is shown that a simple modification of Bethe-Bloch's formula for the stopping power of gases can include this effect very easily. (auth)

10644 (CONF-730804-P1, pp 427-431) RESEARCH OF COSMIC GAMMA-RADIATION FROM CYGNUS REGION. Galper, A. M.; Kirillov-Ugryumov, V. G.; Kurochkin, A. V.; Luchkov, B. I.; Yurkin, Yu. T. (Engineering Physical Inst., Moscow). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The results of a balloon flight with a spark-chamber gamma-telescope made in October 1972 on a geographical latitude 53°N are given. Gamma rays with energies ≥40 MeV were measured. The region of the sky in the vicinity of Cygnus was observed. (auth)

10645 (CONF-730804-P1, pp 433-438) GAMMA-RAY OBSERVATION OF THE GALACTIC PLANE AND POINT SOURCES IN THE SOUTHERN HEMISPHERE. Kinzer, R. L.; Share, G. H.; Seeman, N. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A γ-ray telescope having an angular resolution of about 1½° has detected a significant excess of radiation over background from the vicinity of the galactic center. The radiation, above 15 MeV, appears to be concentrated in a narrow band about 3° wide along the galactic equator. The possibility that point sources contribute to this excess cannot be ruled out. Comparison of the flux with measurements at higher energies suggests that the emitted spectrum may be softer than a pure π^0-decay spectrum. The existence of point sources at energies >100 MeV in the vicinity of the galactic center have been reported by other experimenters; we are unable to confirm the existence of any of these suspected sources. (auth)

10646 (CONF-730804-P1, pp 450-455) OBSERVATION OF COSMIC GAMMA-RAYS FROM THE REGION OF THE NORTH GALACTIC POLE. Galper, A. M.; Kirillov-Ugryumov, V. G.; Luchkov, B. I.; Ozerov, Yu. V. (Engineering Physical Inst., Moscow). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Measurements are presented of primary cosmic gamma-rays performed with a wide-gap spark chamber gamma-telescope on board "Cosmos-264." A gamma-ray emission with energies above 100 MeV from four regions in the vicinity of the North Galactic Pole has been discovered. The fluxes from these regions are (3 to 5) 10^{-5} $(cm^2\ sec)^{-1}$, that is 3 to 4 standard deviation effect. The report also gives the upper limits of fluxes from some other possible sources. (auth)

10647 (CONF-730804-P1, pp 463-467) GALACTIC GAMMA-RAYS AND THE DISTRIBUTION OF COSMIC RAYS. Strong, A. W.; Wdowczyk, J.; Wolfendale, A. W. (Univ., Durham, Eng.). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

It is possible that observations of γ rays from inelastic p-p collisions in the Galaxy will allow useful information to be obtained about the distribution of cosmic-ray protons in the Galaxy. In particular it might be possible to distinguish between galactic and extragalactic origin for the protons (E_p ~ few GeV) responsible for the γ rays. Using the information available on the spatial distribution of neutral hydrogen in the Galaxy an investigation has been started to determine the expected distribution of γ rays for various proton distributions. It is shown that the results of Kraushaar et al. (1972) are roughly in accord with a model in which the cosmic-ray density is proportional to the magnetic-field strength. (auth)

10648 (CONF-730804-P1, pp 468-471) π^0-DECAY γ RAYS FROM THE GALAXY AND THE INTERSTELLAR GAS CONTENT. Stecker, F. W. (Goddard Space Flight Center, Greenbelt, MD). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The total γ-ray production rate per H atom from the decay of π^0-mesons produced in interstellar cosmic-ray interactions is recalculated using the latest accelerator data on the production of π^0-mesons in pp interactions up to ~300 GeV. A simple but accurate approximation used here resolves the past disagreement over the magnitude of this rate. An upper limit is obtained for this rate by considering a maximum galactic cosmic-ray spectrum taking modulation into account. The upper limit is $(1.51 \pm 0.23) \times 10^{-25}$ s^{-1} consistent with the observed upper limit of 1.6×10^{-25} s^{-1}. (auth)

10649 (CONF-730804-P1, pp 472-477) PREDICTED INTENSITIES OF COSMIC RAY PRODUCED GAMMA-RAY LINES. Rygg, T. A. (Marshall Space Flight Center, Huntsville, AL); Fishman, G. J. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The relative intensities of nuclear gamma-ray lines produced by inelastic collisions of low-energy cosmic-ray nuclei with interstellar hydrogen have been calculated using assumed interstellar spectra which are power laws in kinetic energy: $\phi = KE^{-\gamma}$ ($1 \leq E \leq 40$ MeV). The intensity of the line at 511 keV produced by the annihilation of positrons emitted by radioactive nuclei resulting from similar collisions was also calculated. The 478 keV gamma ray due to inelastic scattering of ^{7}Li is more intense than the positron line for spectral indices $\gamma \geq 2.0$ assuming that presently accepted cosmic-ray abundances apply at low energies. Line intensities comparable to ^{7}Li are predicted for ^{24}Mg, ^{20}Ne, and ^{12}C while those of ^{56}Fe, ^{28}Si, and ^{16}O are less intense by factors of three to five. (auth)

10650 (CONF-730804-P1, pp 479-483) γ RAYS OF ULTRA-HIGH ENERGY. Berezinskii, V. S.; Grigor'eva, S. I.; Prilutskii, O. F. (Academy of Sciences, Moscow, USSR). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The intensity of γ rays produced in collisions of metagalactic protons with microwave photons is calculated. The interaction with radio background radiation and spectrum shape of metagalactic protons are taken into account. The cascade equations are solved. (auth)

10651 (CONF-730804-P1, pp 484-489) MEASUREMENTS OF THE COSMIC-RAY Be/B RATIO AND THE AGE OF COSMIC RAYS. Brown, J. W.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The ratio Be/B depends on whether the confinement time of cosmic rays in the Galaxy is long or short compared to the radioactive half-life of ^{10}Be. Observations of this ratio are reported which were obtained with a dE/dx-Cherenkov detector launched into a polar orbit on OGO-6. Be/B ratios were determined for various rigidity thresholds up to 15 GV. No statistically significant rigidity dependence of the ratio, which is 0.41 ± 0.02 when averaged over all observed cutoffs, was found. When averaged over cutoffs ≥1.8 GV, the ratio is 0.43 ± 0.03, which can be compared directly to the ratio of 0.42 ± 0.06 calculated by O'Dell, Shapiro, Silberberg, and Tsao assuming ^{10}Be survival. Additional calculations suggest that if the present fragmentation parameters are correct, then the lifetime of cosmic rays in the Galaxy is $<10^7$ y. (auth)

10652 (CONF-730804-P1, pp 490-493) NEW OBSERVATIONS OF Be/B IN COSMIC RAYS. O'Dell, F. W.; Shapiro, M. M.; Silberberg, R.; Tsao, C. H. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The residence time of cosmic rays in the Galaxy can be estimated from measurements determined by the fractional survival of the tracer ^{10}Be. Using an emulsion detector flown over Texas in 1969, a Be/B ratio, corrected to the top of the atmosphere, of 0.37 ± 0.03 was found. This agrees with values deduced from other experiments at similar rigidities. Comparing the observed values with the calculated ratio 0.39 ± 0.05 expected for total survival of ^{10}Be, and with 0.285 ± 0.04 for total decay, it is concluded that most ^{10}Be nuclei survive at relativistic energies, and infer an upper limit of ten million years for the dwell time of cosmic-ray nuclei in the Galaxy. (auth)

10653 (CONF-730804-P1, pp 494-499) ^{10}Be PROBLEM—MYTH VS REALITY. Raisbeck, G.; Yiou, F. (Centre de Spectrometrie Nucleaire, Orsay, France). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A review of the "^{10}Be problem" is given in light of recent half-life and production cross section measurements. It is shown that under almost any conditions the fraction of Be occurring as ^{10}Be will be very small, and thus precludes any conclusions based on observed elemental ratios. A direct measurement of the isotopic abundance of ^{10}Be will be necessary before this nuclide can be used as a "horloge." (auth)

10654 (CONF-730804-P1, pp 500-505) IS THE RESIDENCE TIME OF THE COSMIC RAYS IN THE GALAXY ENERGY-DEPENDENT? Cowsik, R.; Wilson, L. W. (Univ. of California, Berkeley). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Recent observational data indicate that (1) the spectra of primary cosmic-ray nuclei in the energy range 3 to 50 GeV/N become progressively flatter with increasing Z, and (2) the ratios of the fluxes of secondary nuclei to that of their parents are decreasing functions of energy in the same range. A model is presented to explain these observations. It is assumed that: (a) all cosmic ray nuclei are accelerated to identical spectra, $\sim E^{-2.6}$; (b) subsequent to the acceleration process the cosmic rays diffuse away from the sources, in an energy dependent fashion; and (c) further transport in the interstellar medium and leakage from the Galaxy are energy-independent. Abundances and spectral shapes calculated on this basis are in agreement with the observations, if the effective grammage during diffusion in the neighborhood of the sources varies as $\sim 1.7 \exp(-E/7.85\ \mathrm{GeV/n})$ g cm^{-2}, with a subsequent traversal of ~ 1.6 g cm^{-2} of interstellar matter during their residence time in the Galaxy. The present model is also consistent with the early observations at higher energies using giant emulsion stacks, leads to no serious conflict with limits on anisotropy at high energies and does not aggravate the power requirement from the cosmic-ray sources. Finally, a test is pointed out to distinguish between the various models. (auth)

10655 (CONF-730804-P1, pp 506-511) MONTE CARLO CALCULATIONS OF CROSS SECTIONS NEEDED IN COSMIC-RAY PHYSICS. Silberberg, R.; Tsao, C. H. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The relative merits of current techniques for calculating nuclear breakup cross sections that are useful in many disciplines were examined. The Monte Carlo calculations have certain advantages over the semiempirical ones: (a) they yield distributions in angle and energy for the ejected nucleons, (b) they are applicable to neutron-induced nuclear reactions, and (c) they are superior to the semiempirical calculations at low energies ($E \lesssim 60$ MeV). It was found that the Monte Carlo calculations are as good as the semiempirical ones for the following reactions: (1) peripheral reactions, (2) (p,xn) reactions, after a renormalization, and (3) with heavy nuclei, $29 \leq Z_t \leq 83$, if $\Delta A \leq 25$. However, the semiempirical calculations are faster by orders of magnitude. Furthermore, at the present time, the Monte Carlo calculations are not applicable at energies above 400 MeV. (auth)

10656 (CONF-730804-P1, pp 512-516) EXPERIMENTAL MEASUREMENTS OF NUCLEAR CROSS SECTIONS RELEVANT TO THE COSMIC-RAY SPALLATION PROCESS. Yiou, F.; Raisbeck, G.; Perron, C.; Fontes, P. (Centre de Spectrometrie Nucleaire, Orsay, France). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A summary is given of the current status of the Orsay program for measuring nuclear cross sections relevant to the cosmic-ray spallation problem. A brief description of the experimental technique is given, along with some recent results. (auth)

10657 (CONF-730804-P1, pp 517-521) MODEL FOR ASTROPHYSICAL SPALLATION REACTIONS. Schmitt, W. F.; Ayres, C. L.; Merker, M.; Shen, B. S. P. (Univ. of Pennsylvania, Philadelphia). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A Monte-Carlo model (RENO) for spallation reactions is described which can treat both the spallations induced by a free nucleon and those induced by a complex nucleus. It differs from other such models in that it employs a discrete-nucleon representation of the nucleus and allows clusters of nucleons to form and to participate in the reaction. The RENO model is particularly suited for spallations involving the relatively light nuclei of astrophysical and cosmic-ray interest. (auth)

10658 (CONF-730804-P1, pp 522-527) CALCULATION OF ASTROPHYSICAL SPALLATION REACTIONS USING THE RENO MODEL. Ayres, C. L.; Schmitt, W. F.; Merker, M.; Shen, B. S. P. (Univ. of Pennsylvania, Philadelphia). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The RENO model for the Monte-Carlo treatment of astrophysical spallation reactions has been used to generate preliminary cross sections for the purpose of illustrating the discrete-nucleon approach to spallation modeling and to exhibit differences between two versions of RENO. Comparisons with experimental, theoretical, and semi-empirical data demonstrate the practicability of the discrete-nucleon approach. (auth)

10659 (CONF-730804-P1, pp 528-533) SEMIEMPIRICAL RELATIONS FOR (p,xn) REACTIONS, AND SOME APPLICATIONS TO ASTROPHYSICS. Silberberg, R.; Tsao, C. H. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

In (p,xn) reactions the incident proton is absorbed or undergoes charge exchange, and x neutrons are emitted. Those that have been measured show huge partial cross sections at low energies, but there is generally a scarcity of experimental data. These reactions are important for astrophysical studies carried out in an environment subject to solar flare particles, or in the radiation belts. Hitherto, the cross sections for (p,xn) reactions have been calculated by Monte Carlo techniques down to energies of ~15 MeV, and compared with measured values. Semiempirical equations have been developed that yield equally good results, with orders of magnitude less computing time. The range of $\sigma_{calc}/\sigma_{expt}$ that corresponds to one standard is 0.6 to 1.6. For (p,n) reactions the semiempirical calculation (for nuclei with mass number $A_t > 40$) is applicable down to 5 MeV; for x = 2 down to 15 MeV; and, in general, for any x the equations are valid for $E(\mathrm{MeV}) \gtrsim 10x - 5$. For nuclei with $A_t \lesssim 40$, the threshold of applicability is raised by 15 MeV. (auth)

10660 (CONF-730804-P1, pp 534-539) ELECTRON CAPTURE ISOTOPES IN COSMIC RAYS AS ASTROPHYSICAL PROBES. Raisbeck, G.; Perron, C.; Toussaint, J.; Yiou, F. (Centre de Spectrometrie Nucleaire, Orsay, France). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A discussion is given of the behavior of cosmic-ray orbital electron capture nuclides in interstellar space. It is shown that the sensitivity of the decay of these isotopes to various assumed conditions of production, acceleration, propagation, and modulation, in principle permits their use as astrophysical probes of these processes. (auth)

10661 (CONF-730804-P1, pp 540-545) FRAGMENTATION PARAMETERS AND COSMIC-RAY CHARGE SPECTRA. Wefel, J. P.; Kidd, J. M. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Utilizing high-energy heavy-ion beams, fragmentation parameters were determined for (a) interactions of neon ions with carbon as measured in nuclear emulsion, at velocities $\beta \sim 0.7$ and $\beta \sim 0.6$, and (b) nitrogen-ion interactions in liquid hydrogen as measured with a scintillation counter telescope at $\beta \sim 0.75$. The preliminary results compare favorably with fragmentation parameters measured previously for cosmic-ray interactions in nuclear emulsion and with fragmentation parameters calculated from semi-empirical cross-section formulas. (auth)

10662 (CONF-730804-P1, pp 546-550) ^{56}Ni IN COSMIC RAYS. Casse, M. (CEN de Saclay, Gif sur Yvette, France). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The doubly magic ^{56}Ni is currently believed to be the most abundant nucleus resulting from explosive silicon burning. Under laboratory conditions ^{56}Ni is an almost pure (>99%) electron capture nucleus (T = 6.1d). When completely ionized ^{56}Ni is β^+ unstable with an half-life which is evaluated to be in the range of 10^5 to 10^6 y. If during a supernovae explosion ^{56}Ni nuclei are directly accelerated to cosmic-ray energies they could provide an opportunity to estimate the time elapsed between acceleration and detection. (auth)

10663 (CONF-730804-P1, pp 551-555) INTERACTION MEAN FREE PATH OF ^{20}Ne IN NUCLEAR EMULSION. Adams, J. H. Jr.; Kidd, J. M.; Silberberg, R.; Wefel, J. P. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The interaction mean free path of ^{20}Ne nuclei was measured in an emulsion stack exposed to a 430 MeV/amu ^{20}Ne beam at the Princeton Particle Accelerator. The measurement was made by following many tracks a short distance into the emulsion. The interactions were being divided into two groups according to the apparent change in charge of the incident nucleus. Preliminary results indicated that λ_t, the total interaction mean free path, is 8.6 ± 1.0 cm $\leq \lambda_t \leq 10.4 \pm 1.0$ cm. (auth)

10664 (CONF-730804-P1, pp 556-561) ELEMENTAL ABUNDANCE RATIOS OF INTERSTELLAR SECONDARY AND PRIMARY COSMIC RAYS. Brown, J. W.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The rigidity dependence of the ratios of abundances of interstellar secondary and primary cosmic rays contains important information on their confinement and propagation in the Galaxy. Recent results suggest that high-energy cosmic rays (>20 GeV/N) have propagated through much less interstellar matter than lower energy nuclei (<1 GeV/N). New observations of abundances in the charge range $2 \leq Z \leq 10$ are reported, which were obtained with a dE/dX-Cherenkov detector launched into a polar orbit on OGO-6 as part of the Caltech Solar and Galactic Cosmic Ray Experiment. Integral rigidity spectra of all the elements observed had shapes similar to that of the helium spectrum in the rigidity range ~2 to ~14 GV, approaching a power law with exponent −1.6 above 8 GV. Calculations of interstellar propagation assuming a steady-state model and including the presence of interstellar helium and the effects of solar modulation predict a variation with rigidity of ratios such as Be/O and B/O, which is not observed. The data can be explained by assuming a rigidity-dependent confinement of cosmic rays within the Galaxy. (auth)

10665 (CONF-730804-P1, pp 562-565) CALCULATION OF EXPECTED FLUX OF ANTI-PROTONS AT EARTH DUE TO COLLISIONS OF PRIMARY COSMIC RAYS WITH INTERSTELLAR HYDROGEN. Geisser, T. K.; Maurer, R. H. (Bartol Research Foundation, Swarthmore, PA). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A conservative upper limit of $\sim 4.6 \times 10^{-4}$ is placed on the fraction of antiprotons expected in the cosmic-ray flux at the top of Earth's atmosphere due to collisions of primary cosmic rays with interstellar hydrogen. The implication of this result for experiments designed to detect the existence of antimatter in the Universe is discussed. Existing data on the $\bar{p}$ inclusive cross section from threshold to ISR energies were parametrized to obtain the result. (auth)

10666 (CONF-730804-P1, pp 567-572) EXPERIMENTAL TESTS OF COSMIC-RAY PROPAGATION AND ORIGIN. Silberberg, R.; Shapiro, M. M.; Tsao, C. H. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The relative abundances of the ten most plentiful elements (H, He, C, O, Ne, Mg, Si, Fe, N, and S) in cosmic rays at the source regions are now known with a precision of about 15%. Hence, the constraints on nucleosynthesis or injection of cosmic rays can be refined. Several experimental tests are proposed to check whether the source composition of cosmic rays (a) reflects that of supernova ejecta, or (b) arises mainly from differences in ionization potentials or ionization cross sections. At present, the former suggestion appears somewhat more likely. Certain constraints on the amount of material traversed in source regions are also explored. This path length inside the sources appears to be negligible if (1) cosmic rays with energies $\sim 10^9$ eV originate in supernova remnants about 3 to 10 years after the explosion (Kulsrud et al. 1972), and (2) the magnetic field in the remnant nebula is $\lesssim 0.01$ gauss. If cosmic rays are extragalactic, the secondary nuclei (e.g., Li, Be, B) are still formed in the Galaxy, and the diffusion period through the disk is $\gtrsim 10^6$ years. (auth)

10667 (CONF-730804-P1, pp 573-577) SOURCE SPECTRUM AND THE PROPAGATION OF COSMIC-RAY NUCLEI FROM THE OBSERVATIONS OF H^1, H^2, He^3, and He^4 NUCLEI NEAR THE EARTH. Biswas, S.; Ramadurai, S. (Tata Inst. of Fundamental Research, Bombay). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The results of detailed calculations on the production of H^2 and He^3 nuclei by cosmic-ray protons and helium nuclei in collision with interstellar gas are presented. The flux and energy spectra of these nuclei as well as those of H^1 and He^4 in nearby interstellar space are calculated. The fluxes near the Earth are obtained from the numerical solution of the Fokker–Planck equation describing the diffusion, convection, and adiabatic deceleration of cosmic-ray nuclei in interplanetary space. On comparing the calculated values of H^2/He^4 and He^3/He^4 as a function of energy with the observed data of several investigators it is found that the agreement between the calculated values and the observed data is obtained on the basis of (a) source spectrum as Fermi Spectrum which is intermediate between the power law in rigidity and in total energy/nucleon, (b) gaussian distribution of path lengths with a mean value of 4 g·cm^{-2} and (c) also with exponential distribution of path lengths with leakage path length of 4 g·cm^{-2}. (auth)

10668 (CONF-730804-P1, pp 578-583) RELATIVE ABUNDANCES OF COSMIC RAY NUCLEI AT THE SOURCES. Shapiro, M. M.; Silberberg, R.; Tsao, C. H. (Naval Research Lab., Washington, DC). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Abundances of relativistic cosmic rays have been extrapolated back to the source regions, using improved data on "arriving" abundances and on breakup cross sections. The relative abundances at the source (normalized to 100 carbon nuclei) are: H, 5×10^4; He, 2600; C, 100; N, 11; O, 107; Ne, 16; Na, ~0.8; Mg, 23; Al, ~2; Si, 20.4; S, 3; Ar, ~0.7; Ca, ~2; Fe, 20.5; Ni, 0.8; P, Cr and Mn are less than 0.6, each. For heavier nuclei, the abundances (normalized to 10^6 for Fe) are: $J(29 \leq Z \leq 33) = 3000$, $J(34 \leq Z \leq 40) = 130$, $J(41 \leq Z \leq 49) = 5$, $J(50 \leq Z \leq 60) = 12$, $J(61 \leq Z \leq 74) = 3$, $J(75 \leq Z \leq 80) = 3$, $J(81 \leq Z \leq 83) = 2$, $J(90 \leq Z \leq 96) = 2$. The uncertainty for these heavier elements is about a factor of 2. If the composition of cosmic rays is compared to that of the solar system, normalizing the abundances in each case to the respective mean of Mg, Si, and Fe, the light elements at cosmic-ray sources are notably underabundant: H by a factor ~14, He by ~24, C by ~2, N by ~6, and O by ~4. Also, S and Ar may be underabundant in cosmic rays by a factor of ~2. (auth)

10669 (CONF-730804-P1, pp 584-589) ATOMIC PROPERTIES OF THE ELEMENTS AND THEIR ACCELERATION TO THE COSMIC-RAY ENERGIES. Casse, M.; Goret, P. (CEN de Saclay, Gif sur Yvette, France). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The cosmic-ray source composition is inferred from recent observational data using a set of spallation cross sections derived, for the most, from the semi-empirical relations of Shapiro and Silberberg. Anomalies with respect to silicon burning nucleosynthesis suggest a selective acceleration mechanism. This idea is further strenghtened by the appearance of a quasi-exponential correlation between the cosmic-ray source "overabundances" with respect to the solar system composition and the first ionization potential of the corresponding atoms. Physical conditions in which such a process could take place are discussed. (auth)

10670 (CONF-730804-P1, pp 591-596) ORIGIN OF GALACTIC COSMIC RAYS. Lavrukhina, A. K. (Academy of Sciences, Moscow). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The idea is considered that the products of nuclear reactions

by high-energy particles are indicators of processes during which arise galactic cosmic rays. The sequence of processes of nucleosynthesis and acceleration of proton and other nuclei is described. It is shown that the proton-rich isotopes are formed by high-energy nucleon spallation reactions in the shock wave matter which in the quasiequilibrium process the s-process and the first stage of the r-process was created. The isotopes of heavy elements, formed during the second stage of the r-process, do not take part in the spallation reactions. The duration of this process lies in intervals (1 to 10) sec $< \tau \leq 9 \cdot 10^3$ sec. This τ_s^{max} value coincides with the duration of the cosmic-ray acceleration by shock waves during the supernova explosion. The chemical composition of cosmic rays in these processes must correspond to the chemical composition of the shock wave matter. (auth)

10671 (CONF-730804-P1, pp 597-602) GALACTIC DIFFUSION OF EXTRAGALACTIC COSMIC RAYS. Sitte, K.; Dardo, M. (Univ. of Freiburg i. B.). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The galactic modulation of the energy spectrum of extragalactic cosmic radiation is discussed, assuming conditions of free diffusion in the halo and of restricted diffusion in the disk. It is shown that the observed spectrum is incompatible, with extragalactic origin if the galaxy has a halo. But a universal cosmic radiation, and perhaps also an origin at a distant source in the local supercluster, cannot be ruled out. (auth)

10672 (CONF-730804-P1, pp 603-609) METAGALACTIC PROTONS OF ULTRA HIGH ENERGIES. Berezinskii, V. S.; Grigor'eva, S. I.; Zatsepin, G. T. (Academy of Sciences, Moscow). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The metagalactic cosmic protons of ultra high energies near the Galaxy is shown to be produced mainly in the normal galaxies. The flux of these protons is calculated. The observed spectrum can have a sloping angle with abrupt steepening at $E \sim 3 \cdot 10^{19}$ eV, or due to the fluctuations in the space distribution of the normal galaxies, the combined spectrum can have at $E \sim 3 \cdot 10^{19}$ eV less marked steepening ($\Delta\gamma \approx 1.6$) without angle at smaller energies. (auth)

10673 (CONF-730804-P1, pp 610-615) GALACTIC MAGNETIC FIELD IRREGULARITIES AND THE ORIGIN OF COSMIC RAYS ABOVE 10^{17} eV. Osborne, J. T.; Wolfendale, A. W. (Univ., Durham, Eng.). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Previous work comparing the arrival directions of cosmic rays with their predicted distributions assuming galactic origin and propagation in the galactic magnetic field is extended by taking into account irregularities in the field. A model for the irregular component has been formulated from an examination of the astronomical data. If the high-energy cosmic rays are mainly protons then, in the region of 10^{18} eV to 10^{19} eV, at least 80% of them must be of extraglactic origin. There is no significant correlation between the arrival directions of cosmic rays above 10^{19} eV and the positions of known pulsars. (auth)

10674 (CONF-730804-P1, pp 616-620) ISOTROPY OF UNDERGROUND MUONS. Barrowes, S. C.; Elbert, J.; Jaehne, E.; Mason, G.; Bergeson, H. E. (Univ. of Utah, Salt Lake City). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The present anisotropy search, reflecting the arrival directions of about 375,000 primary cosmic rays of energy greater than 5 TeV, was motivated by a theory which predicts the number of narrow-angle anisotropies to be expected on the basis of the galactic magnetic field being smooth on the small scale. The binning of underground muon events by different slant depths and muon multiplicities provided data at a number of energy ranges from 5 TeV to greater than 150 TeV. The degree of isotropy observed requires a significant amount of scattering at these energies over the cosmic-ray lifetime. No significant anisotropies were observed. (auth)

10675 (CONF-730804-P1, pp 621-626) COSMIC-RAY PREHISTORY AND PROPAGATION. Lingenfelter, R. E.; Higdon, J. C. (Univ. of California, Los Angeles). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The possibility is considered that measured variations in ^{10}Be and ^{26}Al activity in deep sea sediments result from an increase in the local cosmic-ray intensity produced by a nearby supernova explosion, and the implications of such an association on models of cosmic-ray propagation are discussed. (auth)

10676 (CONF-730804-P1, pp 627-632) ABSORPTION OF HIGH-ENERGY HEAVY NUCLEI AND GAMMA RAYS AT THE SURFACE OF HOT NEUTRON STARS. Rengarajan, T. N. (Tata Inst. of Fundamental Research, Bombay). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

In the early stages of a pulsar when a large fraction of the rotational energy loss of the central neutron star is likely to be converted into high-energy cosmic rays and gamma rays, the surface temperature of the neutron star is also high. The interaction between the blackbody photons from the surface of the neutron star and high-energy heavy nuclei and gamma rays that may be generated at the surface is considered. It is found that in the early stages when the temperature is $\sim 10^7$ °K gamma rays in the energy range of 100 MeV to ~1 TeV and iron nuclei of 10^{13} to $\sim 10^{15}$ eV/N get destroyed. (auth)

10677 (CONF-730804-P1, pp 634-638) ORIGIN OF COSMIC RAYS. Cohen, J. M.; Ramaty, R. (Univ. of Pennsylvania, Philadelphia). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Presented is a model in which cosmic electrons (>100 MeV) are produced by pulsars, and cosmic protons and alpha particles are accelerated by shock waves in supernova envelopes. It is argued that neither mechanism by itself can produce both the observed protons and electrons at energies above a few hundred MeV. But supernova accelerated electrons could constitute the majority of cosmic electrons with energy below about 10 MeV. (auth)

10678 (CONF-730804-P1, pp 640-643) FORMATION OF SUPERHEAVY ELEMENTS IN THE SUPERNOVA BURSTS. Berlovich, E. Ye.; Novikov, Yu. N. (Nuclear Physics Inst., Leningrad). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The origin of superheavy nuclei in R-process nucleosynthesis is briefly discussed. (WDM)

10679 (CONF-730804-P1, pp 646-651) ORIGIN OF COSMIC RAYS IN EXPLOSIONS OF MASSIVE STARS. Schramm, D. N.; Arnett, W. D. (Univ. of Texas, Austin). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Explosions of massive stars (>8 $M_\odot$) are examined as the source of galactic cosmic rays. Detailed nucleosynthetic calculations suggest that these massive stars produce the heavy elements (carbon and above) in their proper relative abundances. This is particularly significant because lower mass stars (in particular the 4 to 8 $M_\odot$ range) are not able to produce the observed abundances of C and O relative to the iron peak. The proportion of heavy elements to helium and hydrogen in the ejected material from these massive stars can give a reasonable match to the observed cosmic-ray data. A small (~ 1.4 $M_\odot$) dense remnant star left after the explosion may provide a location for an electromagnetic acceleration mechanism. The conditions at the outer edge of the remnant and the inner edge of the ejected material may be appropriate for an r-process to occur. This is fortunate since the high Z cosmic rays seem to show an enrichment of r-process material. It thus appears that stars >8 $M_\odot$ may be the astrophysical source for the galactic cosmic rays. (auth)

10680 (N-74-12456) POSSIBLE EVIDENCE FOR STRUCTURED ACCELERATION OF COSMIC RAYS ON A GALACTIC SCALE FROM RECENT GAMMA RAY OBSERVATIONS. Stecker, F. W.; Puget, J. L.; Strong, A. W.; Bredekamp, J. H. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Nov 1973. 13p. NTIS $3.00.

Recent data from SAS-2 on the galactic gamma-ray line flux as a function of longitude reveals a broad maximum in the region of <30°. This data, as unfolded here, implies that the low-energy (1 to 10 GeV) galactic cosmic-ray flux varies with the radial distance, omega, from the galactic center and is about an order of magnitude higher than the local value in a toroidal region for omega between 4 and 5 kpc. It is shown that this enhancement can be plausibly accounted for by Fermi acceleration caused by a hydrodynamic shock driven by the expanding gas in the 3 kpc arm and invoked in some versions of galactic structure theory. (auth) (STAR)

10681 (N-74-13534) FOKKER–PLANCK COEFFICIENT FOR PITCH-ANGLE SCATTERING OF COSMIC RAYS. Fisk, L. A.; Goldstein, M. L.; Klimas, A. J.; Sandri, G. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Oct 1973. 37p. (NASA-TM-X-70527; X-660-73-320). NTIS $4.00.

For the case of homogeneous, isotropic magnetic field fluctuations, it is shown that most theories which are based on the quasi-linear and adiabatic approximation yield the same integral for the Fokker–Planck coefficient for the pitch angle scattering of cosmic rays. For example, despite apparent differences, the theories due to Jokipii and to Klimas and Sandri yield the same integral. It is also shown, however, that this integral in most cases has been evaluated incorrectly in the past. For large pitch angles these errors become significant, and for pitch angles of 90° the actual Fokker–Planck coefficient contains a delta function. The implications for these corrections relating cosmic-ray diffusion coefficients to observed properties of the interplanetary magnetic field are discussed. (auth)

10682 (N-74-14458) ORIGIN AND PROPAGATION OF VVH PRIMARY COSMIC RAY PARTICLES. Blanford, G. E. Jr.; Friedlander, M. W.; Klarmann, J.; Walker, R. M.; Wefel, J. P. (Washington Univ., St. Louis, Mo. (USA)). 1972. 5p. (NASA-CR-136366). NTIS $3.00.

Several source spectra were constructed from combinations of 4- and s-process nuclei to match the observed charge spectrum of VVH particles. Their propagation was then followed, allowing for interactions and decay, and comparisons were made between the calculated near-earth spectra and those observed during high altitude balloon flights. None of the models gave good agreement with observations. (auth) (STAR)

10683 POSSIBLE EVIDENCE FOR STRUCTURED ACCELERATION OF COSMIC RAYS ON A GALACTIC SCALE FROM RECENT γ-RAY OBSERVATIONS. Stecker, F.W. (NASA/Goddard Space Flight Center, Theoretical Studies Branch, Greenbelt, Maryland 20771); Puget, J.L.; Strong, A.W.; Bredekamp, J.H. Astrophys. J. Lett. 188: No. 2, L59-L61 (1 Mar 1974).

Recent data from SAS-2 on the galactic γ-ray line flux as a function of longitude reveal a broad maximum in the region $|l| \leq 30°$. These data, as unfolded here, imply that the low-energy (1–10 GeV) galactic cosmic-ray flux varies with the radial distance, $\tilde{\omega}$, from the galactic center and is about an order of magnitude higher than the local value in a toroidal region for $\tilde{\omega}$ between 4 and 4 kpc. We further show that this enhancement can be plausibly accounted for by Fermi acceleration and compression caused by a hydrodynamic shock driven by the expanding gas in the "3-kpc" arm and invoked in some versions of galactic structure theory. (auth)

10684 COSMIC GAMMA-RAY BURSTS FROM DIRECTED STELLAR FLARES. Brecher, K.; Morrison, P. (Department of Physics and Center for Space Research, Massachusetts Institute of Technology). Astrophys. J. Lett. 187: No. 3, L97-L100 (1 Feb 1974).

We suggest that the recently observed nonsolar γ-ray bursts arise in directed stellar flares, hypothetical events akin to giant transient coronal streamers. Directed beams of inverse-Compton scattered photons could produce the time structure, spectrum, and intensity observed, and would require and energetic extrapolation smaller than in a model of wide-angle thick-target bremsstrahlung radiation directly analogous to observed solar X-ray bursts. (auth)

10685 THE ANOMALOUS ABUNDANCE OF COSMIC-RAY NITROGEN AND OXYGEN NUCLEI AT LOW ENERGIES. McDonald, F.B.; Teegarden, B.J.; Trainor, J.H. (NASA Goddard Space Flight Center, Greenbelt, Maryland); Webber, W.R. Astrophys. J. Lett. 187: No. 3, L105-L108 (1 Feb 1974).

Recent measurements using the Goddard–University of New Hampshire cosmic-ray telescope on the Pioneer 10 spacecraft have revealed an anomalous spectrum of nitrogen and oxygen nuclei relative to other nuclei such as He and C, in the energy range 3–30 MeV per nucleon. The intensity of nitrogen and oxygen nuclei is enhanced by a factor of up to 20 relative to their abundance in galactic or solar cosmic rays. It is argued that this is most likely a new extrasolar component of cosmic rays. (auth)

10686 A PRELIMINARY CATALOG OF TRANSIENT COSMIC GAMMA-RAY SOURCES OBSERVED BY THE VELA SATELLITES. Strong, I.B.; Klebesadel, R.W.; Olson, R.A. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544). Astrophys. J. Lett. 188: No. 1, L1-L4 (15 Feb 1974).

The times of occurrence are given for all cosmic γ-ray bursts, detected thus far by at least two satellites of the Vela satellite system. Preliminary information on source directions, energy fluxes, and other characteristics is also given. (auth)

10687 COSMIC GAMMA-RAY BURSTS FROM RELATIVISTIC DUST GRAINS. Grindlay, J.E.; Fazio, G.G. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory, Cambridge, Massachusetts 02138). Astrophys. J. Lett. 187: No. 3, L93-L96 (1 Feb 1974).

A cosmic-ray theory, in which all the observed energy originally resides in one "particle," is developed to account for the principal observed features of cosmic γ-ray bursts. A relativistic iron grain of radius $a \sim 0.1$ cm with $\gamma \sim 10^3$ approaching the Earth will break up at several hundred a.u. and will efficiently scatter solar photons into the observed γ-ray burst via a fluorescence process. Propagation of a limited size range of relativistic grains appears to be possible for several hundred parsecs, and pulsars are considered as possible sources. In particular, two burst events that could be associated with the 1969 glitch of the Crab pulsar are discussed. (auth)

10688 COSMIC GAMMA-RAY BURST DETECTED WITH AN INSTRUMENT ON BOARD THE OGO-5 SATELLITE. L'Heureux, J. (Department of Physics, University of Arizona, Tucson, Arizona 85721). Astrophys. J. Lett. 187: No. 2, L53-L56 (15 Jan 1974).

Gamma-ray bursts of cosmic origin have recently been detected by instruments on the Vela satellites. We now confirm the detection of the 1971 June 30 event with an instrument on board the OGO-5 satellite. The intensity of this burst is calculated to be approximately 100–200 photons cm^{-2} s^{-1} for photons of energy greater than 150 keV with an upper limit of 50 photons cm^{-2} s^{-1} for the intensity above 5 MeV. An upper limit of one-third of the intensity of the 1971 June 30 event is set for 10 other events studied. (auth)

10689 OBSERVATION OF THE SHORT PERIOD VARIATION OF COSMIC-RAY BY BALLOON. Kodama, M. (Inst. of Physical and Chemical Research, Wako, Japan); Sakai, T.; Tamai, E.; Imai, K. Uchusen Kenkyu; 18: No. 1, 49-54(Aug 1973). (In Japanese).

The observation of the short period variation of cosmic rays by a balloon was performed to obtain the zenith angle distribution of cosmic rays and to investigate the effect of the motion of the balloon on the power density of cosmic rays. Two plastic scintillators were used for the observation. One (A) was set vertically and the other (B) horizontally. The balloon was released on September 18, 1972, and the flight time was 16 hours at a height of about 20 km. The intensity of cosmic rays was nearly isotropic. Two types of distribution were assumed. One was $I = I_0 + I_1 \cos^n(\gamma - \varphi)$, where I_0, I_1, γ, and φ are isotropic component, anisotropic component, zenith angle, and initial phase, respectively, and the other was $I = I_1 \cos[(\gamma/n) - \varphi]$. The second type distribution seems to be better than the first one from a comparison of the count of the two detectors. The sum of the count of the two detectors was taken as data. Power spectral density is shown as a function of frequency. Peaks were seen at several cycles per hour. These peaks seem to be due to the variation of cosmic-ray intensity. (JA)

10690 SHORT PERIOD VARIATION OF COSMIC RAY INTENSITY. Kodama, M. (Inst. of Physical and Chemical Research, Wako, Japan). Uchusen Kenkyu; 18: No. 1, 47-48(Aug 1973). (In Japanese).

Few data on the short-period variation of cosmic-ray intensity have been reported, and they are tabulated. It is hard to believe the existence of the short-period variation from the present data, because of lack of data on statistical noise, atmospheric disturbance, and time dependence. Frequency analysis has been made by the power density vs. frequency method so far. The value of the power index in case of cosmic rays is $1.4 \sim 1.9$ in the range of $10^{-3} \sim 10^{-5}$ Hz. Whether the spectrum shows a turning point or there is cut-off as frequency rises high is not clear. There is no information on energy dependence, and (local) time dependence. It is interesting that the shape of power spectrum is similar to that of the magnetic field in interplanetary space. Theoretical investigation on this fact as well as the cause of special period variation is desirable. (JA)

10691 ANNUAL VARIATION OF THE DIURNAL VARIATION IN COSMIC-RAY NEUTRON INTENSITY AND THE THREE-DIMENSIONAL ANISOTROPY. Mori, S. (Shinshu Univ., Matsumoto, Japan). Uchusen Kenkyu; 18: No. 1, 79-105(Aug 1973). (In Japanese).

One of characteristic features of three-dimensional cosmic-ray anisotropy in interplanetary space has been studied, based on an analysis of annual modulation of the cosmic-ray solar diurnal variation. By using the world-wide neutron monitor data, and by taking differences between the intensity variations for some selected pairs of conjugated stations on both northern and southern hemispheres, systematic annual movements of solar diurnal variations are clearly observed for the time-periods of 1964 to 1968. These annual variations of the cosmic-ray solar diurnal variation can be reasonably interpreted in a framework of Nagashima's theory, as resulting from annual modulation of a "special" diurnal term $D_1^1(t)$ due to the Earth's revolution around the Sun. The term of $D_1^1(t)$ is one of terms expected from three-dimensional cosmic-ray anisotropy in interplanetary space responsible for the observed solar semi-diurnal variation, and its character is discussed. (auth)

10692 SHORT PERIOD VARIATION OF COSMIC-RAY AND WAVE MOTION OF ATMOSPHERE. Kitamura, M. (Meteorological Research Inst., Tokyo). Uchusen Kenkyu; 18: No. 1, 55-60(Aug 1973). (In Japanese).

The relation between the short-period variation of cosmic-rays and the wave motion of the atmosphere is discussed. The time variation of the peak height of the atmospheric wave motion was observed with a lidar. The up-down wave motion with an amplitude of 100 m was seen at the height of 1500 m. The observation by lidar at the height of 10 km was carried out by R. T. H. Collis et al. The results are as follows: The wavelength of the motion was 6 ~ 21 km, and the amplitude was 0.3 ~ 0.5 km. The wind velocity around 10 km was 20 ~ 30 $msec^{-1}$. The wave motion of the atmosphere causes the variation of intensity of the meson component. The rise of the height of isobaric surface increases the intensity. It was found that the variation of 200 m of the height of the isobaric surface around 10 km resulted in a variation of 1% of the intensity of mesons at ground level. The period of variation is 10 ~ 20 min, and equivalent to the period of the short-period variation of cosmic rays. Further experiments will make clear the relation. (JA)

10693 ORIGIN OF LARGE EXTENSIVE AIR SHOWERS OF COSMIC RAYS. Terasaki-Okada, K. (Hiroshima Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 1, 224-229(Jan 1974).

Some difficulties are pointed out for the models of exotic primary cosmic rays introduced to get rid of the difficulty of the cutoff at ~10^{20} eV in the spectrum of primary cosmic rays. In place of these models, urbaryons are considered as primary cosmic rays of ultra-high energies. (auth)

10694 COSMIC-RAY POSITRON AND ELECTRON SPECTRA IN INTERPLANETARY AND INTERSTELLAR SPACE AND THE SOLAR MODULATION OF COSMIC RAYS. Cummings, A. C. Pasadena, CA; California Inst. of Tech. (1973). 281p. University Microfilms Order No. 73-31,038.

Thesis (Ph. D.).

The differential energy spectra of cosmic-ray positrons and negatrons with energies between ~11 and 1500 MeV was measured during the period 1968-1971 using a balloon-borne magnetic spectrometer. These measurements fill a gap in the previously existing data and permit one to determine, within quantitative limits, the interstellar spectra of cosmic-ray positrons and electrons ($e^+ + e^-$). Knowledge of these spectra provides a crucial tool for studies of the distribution and density of matter and magnetic fields in the interstellar medium and the origin and dynamics of energetic particles contained in the fields. (Diss. Abstr. Int., B)

10695 ANGULAR DISTRIBUTION AND ALTITUDE DEPENDENCE OF ATMOSPHERIC NEUTRONS FROM 10 TO 100 MeV. Preszler, A.M.; Simnett, G.M.; White, R.S. (Physics Department and Institute of Geophysics and Planetary Physics, University of California, Riverside, California 92502). J. Geophys. Res. 79: No. 1, 17-22 (1 Jan 1974).

The altitude dependence of atmospheric neutrons from ground level to 5 g/cm^2 of residual atmosphere at neutron energies of 10-100 MeV is reported. Ground level measurements were taken at Cape Girardeau, Missouri, on September 18, 1972. The other measurements were made during ascent and float on launch from Palestine, Texas, on September 26, 1971. The intensity of both the downward- and the upward-moving neutrons is maximum at about 100 g/cm^2 of residual atmosphere. Neutron angular distributions are reported from 20° to 80° and 100° to 160° for 10- to 100-MeV neutrons. Omnidirectional fluxes at altitudes of 5, 50, 100, and 200 g/cm^2 of residual atmosphere are in good agreement with recent theoretical calculations of Armstrong et al. in the three energy intervals of 10-30, 30-50, and 50-100 MeV. (auth)

10696 DIFFUSE COSMIC GAMMA-RADIATION ABOVE 10 MeV. Share, G.H.; Kinzer, R.L.; Seeman, N. (Laboratory for Cosmic Ray Physics, Naval Research Laboratory, Washington, D.C.). Astrophys. J. 187: No. 3, 511-520 (1 Feb 1974).

An investigation of the diffuse component of cosmic γ-radiation above 10 MeV was performed with an emulsion spark-chamber telescope carried to a depth of 2.5 g cm^{-2} at a cutoff rigidity of ~11.5 GV. An upper limit of 3×10^{-3}γ cm^{-2} s^{-1} to the integral flux above 10 MeV was obtained from an extrapolation to the top of the atmosphere. This limit corresponds to a differential intensity of 3.5×10^{-5}γ cm^{-2} s^{-1} $sterad^{-1}$ MeV^{-1} at 30 MeV. Upper limits to the extraterrestrial intensity were also derived from a measurement of the γ-ray spectrum at 2.5 g cm^{-2}. These limits are 5.5×10^{-5}, 2.8×10^{-5}, and $1.3\times^{-5}$γ cm^{-2} s^{-1} $sterad^{-1}$ MeV^{-1} at 20, 30, and 40 MeV, respectively. These and other measurements raise questions concerning the existence of an additional component of diffuse γ-rays suggested above 1 MeV. (auth)

Stars

Refer also to abstracts 10684 and 11794.

10697 (N-74-12479) MANY-PARTICLE THEORY OF NUCLEAR SYSTEMS WITH APPLICATION TO NEUTRON STAR MATTER. Chakkalakal, D. A.; Yang, C. H. (Southern Univ., Baton Rouge, La (USA). Dept. of Physics). 12 Oct 1973. Contract JPL-953549. 29p. NTIS $3.50.

The research is reported concerning energy-density relation for the normal state of neutron star matter, and the effects of superfluidity and polarization on neutron star matter. Considering constraints on variation, and the theory of quantum fluids, three methods for calculating the energy-density range are presented. The effects of polarization on neutron star structure, and polarization effects on condensation and superfluid-state energy are discussed. (STAR)

10698 (N-74-13569) STUDIES OF HYDRODYNAMIC EVENTS IN STELLAR EVOLUTION. 3. Ejection of Planetary Nebulae. Sparks, W. M.; Kutter, G. S. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Dec 1973. 30p. (NASA-TM-X-70536; X-671-73-370). NTIS $3.50.

The dynamic behavior of the H-rich envelope (0.101 solar mass) of an evolved star (1.1 solar mass) as the luminosity rises to 19,000 solar luminosity during the second ascent of the red giant branch, is considered. For luminosities in the range 3100 < L 19,000 solar luminosity the H-rich envelope pulsates like a long-period variable (LPV) with periods of the order of a year. As L reaches 19,000 solar luminosity, the entire H-rich envelope is ejected as a shell with speeds of a few 10 km/s. The ejection occurs on a timescale of a few LPV pulsation periods. This ejection is associated with the formation of a planetary nebula. The computations are based on an implicit hydrodynamic computer code. T- and RHO-dependent opacities and excitation and ionization energies are included. As the H-rich envelope is accelerated off the stellar core, the gap between envelope and core is approximated by a vacuum, filled with radiation. Across the vacuum, the luminosity is conserved and the anisotropy of the radiation is considered as well as the solid angle subtended by the remnant star at the inner surface of the H-rich envelope. Spherical symmetry and the diffusion approximation are assumed. (auth)

10699 FUNCTIONS ENCOUNTERED IN THE RADIATIVE TRANSFER THEORY IN MOVING MEDIA. Vityazev, V. V. Vestn. Leningrad. Univ., Mat., Mekh., Astron.; No. 19, 124-129 (Oct 1973). (In Russian).

The functions K(τ, γ) and L(τ, γ), encountered in the theory of radiative transfer in media moving with the velocity gradient are investigated. The asymptotic expansions and approximate formulae valid in a wide region of γ and τ are obtained. The functions K(τ, γ) and L(γ, τ) are tabulated for $\gamma = 10^{-4}$, 10^{-3} and 10^{-2}. (tr-auth)

10700 SUPERGIANT BINARY STARS. Humphreys, R.M.; Ney, E.P. (University of Minnesota, Minneapolis). Astrophys. J. Lett. 187: No. 2, L75-L80 (15 Jan 1974).

The energy radiated at infrared wavelengths by HD 101584 (F2e Iap) is difficult to reconcile with thermal reradiation by atmospheric grains. It is suggested that the F supergiant has an M supergiant companion. Other possible binaries containing an infrared star are discussed. (auth)

10701 A BROAD ABSORPTION REGION IN THE ULTRAVIOLET SPECTRA OF EARLY-TYPE STARS. Thompson, G.I.; Humphries, C.M.; Nandy, K. (Royal Observatory, Edinburgh, Scotland). Astrophys. J. Lett. 187: No. 2, L81-L84 (15 Jan 1974).

Spectrophotometric measurements at 35 Å resolution with the S2/68 Ultraviolet Sky-Survey Telescope of satellite TD1 have shown the existence of a broad region of absorption centered at 1920 Å in the spectra of many early B-type stars. The absorption, which extends between approximately 1800 and 2150 Å, becomes pronounced for stars of high luminosity and for these stars the observed fluxes at the 1920 Å peak are found to be deficient by up to 0.3 mag. Line blocking is believed to be responsible for the effect. (auth)

10702 THE RECENT SHELL EVENT OF ZETA OPHIUCHI. Irvine, N.J. (Warner and Swasey Observatory, Case Western Reserve University). Astrophys. J. Lett. 188: No. 1, L19-L20 (15 Feb 1974).

Between July 1971 and July 1973, η Oph produced a shell optically thick in the hydrogen lines. Mass outflow observed in the rocket-ultraviolet prior to 1971 is probably related to the formation of the shell. (auth)

10703 MEASUREMENT AND THEORETICAL ANALYSIS OF SOME REACTION RATES OF INTEREST IN SILICON BURNING. Howard, A.J.; Jensen, H.B.; Rios, M.; Fowler, W.A.; Zimmerman, B.A. (California Institute of Technology, Pasadena, California 91109). Astrophys. J. 188: No. 1, 131-139 (15 Feb 1974).

Total cross-sections for the $^{27}Al(a,n)^{30}P$, $^{36}Cl(\alpha,n)^{39}K$, $^{46}Ti(\alpha,n)^{49}Cr$, $^{40}Ca(\alpha,p)^{43}Sc$, and $^{45}Sc(p,n)^{45}Ti$ reactions have been measured in the energy range of importance for nucleosynthesis in

stellar silicon burning. For comparison, reaction cross-sections have been calculated from the statistical theory of nuclear reactions, using an "equivalent square well" in the evaluation of the transmission functions. The calculated cross-sections are in general within a factor of 2 of the experimental values over the measured energy range. Stellar reaction rates, $N_A\langle\sigma v\rangle$, have been deduced from the observed reaction cross-sections and have been represented approximately by theoretically reasonable analytic functions of the temperature. It is shown that estimates for such analytic functions for reactions which have not been measured must take into account the competition between the dominant open reaction channels. The effect of excited states in target and residual nuclei is treated, and an effective overall cross-section is defined and discussed. (auth)

10704 VEILING AND THE PRESENCE OF CIRCUMSTELLAR GAS AND DUST IN SOME INFRARED STARS. Humphreys, R.M. (University of Minnesota, Minneapolis). Astrophys. J. 188: No. 1, 75-85 (15 Feb 1974).

Four high-luminosity M supergiants, VY CMa, VZ Sgr, S Per, and HD 97671, have peculiar energy distributions in the infrared with excess radiation between 1.5 and 8 μ. They show some evidence for excess radiation at the shorter wavelengths as well. In VX Ser, S Per and HD 97671 the radiation between 1.5 and 8μ has the same slope as free-free emission. The stars, VY CMa, VX Sgr, and S Per also have pronounced veiling or absorption-line weakening in their near-infrared spectra, and to a lesser extent in their blue spectra. The energy distributions when corrected for TiO opacity and interstellar extinction reveal 10- and 20-μ emission features from silicate grains. It is suggested that free-free and free-bound emission from electron-neutral hydrogen interactions in the extended atmospheres are responsible for the absorption-line veiling and the peculiar energy distributions. (auth)

10705 COMPLETE LINEARIZATION OF THE INTEGRAL EQUATIONS IN RADIATIVE TRANSFER. Kalkofen, W. (Center of Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory). Astrophys. J. 188: No. 1, 105-119 (15 Feb 1974).

The transfer equation is linearized and a procedure presented for constructing integral operators that give the effect of density perturbations on the specific intensity, the mean intensity, the net rate of photoexcitation, and the equations of statistical equilibrium. An iteration method based on the linearized integral equation is applied to the solution of the equations of radiative transfer and of statistical equilibrium for atomic models with two levels (one line) and three levels (three lines). The method is very much faster than the usual iteration method, which solves equations for equivalent two-level atoms, and it converges rapidly even when begun with extremely poor initial solutions. The features of this method are compared with those of the complete linearization methods of Auer and Mihalas and of Skumanich and Domenico. (auth)

10706 CONSTRAINTS ON THE EVOLUTIONARY HISTORY OF STARS SHOWING s-PROCESSED MATERIAL. Schlesinger, B.M. (Astronomy Department, Indiana University, Bloomington, Indiana 47401). Astrophys. J. 188: No. 1, 141-143 (15 Feb 1974).

In some N carbon stars whose spectra show that other products of the s-process are present, technetium is absent, probably because it has decayed. The half-life of the technetium isotope produced by the s-process is 2×10^5 years; any production of technetium in these stars must therefore have occured at least 5×10^5 years ago. Stars of mass greater than $\sim9\,M_\odot$ are red supergiants for 2×10^5 years or fewer after they exhaust core helium. It follows that unless the stars discussed here have masses less than about $9\,M_\odot$, some production of heavy elements by the s-process occurs before core helium has been exhausted. (auth)

10707 SUPERNOVA: THE RESULT OF THE DEATH SPIRAL OF A WHITE DWARF INTO A RED GIANT. Sparks, W.M.; Stecher, T.P. (Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. 188: No. 1, 149-153 (15 Feb 1974).

The proposed model is a binary consisting of a white dwarf and a star evolving toward the red-giant branch. Conditions are given under which the revolution period of the binary and the rotation period of the red giant will reach a synchronous state and under which no stable synchronous orbit is possible. For the case of a nonstable synchronous orbit, the evolution of the decay of the orbit is given. It is shown that the white dwarf spirals in toward the red giant, enters the red giant's surface, and drops rapidly toward the core. We suggest that a supernova explosion will result from a collision with the core and leave a neutron stellar remnant. The relationship to binary X-ray stars is discussed. (auth)

10708 THE PECULIAR STAR He 2-177: A SLOW NOVA AND A POSSIBLE X-RAY SOURCE. Carlson, E.D. (Adler Planetarium, Chicago, Illinois; and Lindheimer Astronomical Research Center, Northwestern University); Henize, K.G. Astrophys. J. Lett. 188: No. 2, L47-L50 (1 Mar 1974).

The spectrum of the peculiar emission-line star He 2-177 is found to resemble that of the slow nova RR Tel in remarkable detail. The most highly ionized elements visible in 1972 include [Fe VII], O IV, [Ne V], and possibly [Mg VI]. The evolution in the spectrum since 1965 closely resembles the evolution of RR Tel between 1951 and 1954. A newly determined position of the X-ray source 2U 1639-62 makes its identification with He 2-177 less probable than before. (auth)

10709 THE BRIGHT STARS ASSOCIATED WITH GALACTIC X-RAY SOURCES. Sofia, S. (Joint Institute for Laboratory Astrophysics, University of Colorado). Astrophys. J. Lett. 188: No. 2, L45-L46 (1 Mar 1974).

A comparison of 44 galactic compact X-ray sources in the third Uhuru X-ray catalog having error boxes ≤0.02 deg^2 with the stars listed in the Smithsonian Astrophysical Observatory catalog shows eight positional coincidences where only two are expected by chance. Since already three of those stars have been positively identified with the corresponding X-ray sources, and a fourth identification has been proposed, a relationship between bright stars and galactic sources is beyond doubt. This letter identifies the other bright stars which are good candidates to be X-ray counter-parts. (auth)

10710 PRE-MAIN-SEQUENCE STARS. III. HERBIG Be/Ae STARS AND OTHER SELECTED OBJECTS. Breger, M. (University of Texas at Austin and McDonald Observatory). Astrophys. J. 188: No. 1, 53-58 (15 Feb 1974).

The majority of the Herbig Be/Ae stars show considerable linear polarization in contrast to other hot young stars. A dependence on evolutionary phase exists in that the unpolarized stars are on the zero-age main sequence. The amount of polarization does not seem to be correlated with circumstellar shell parameters such as reddening and infrared excesses. Also, no correlation with v sin i and hence possible circumstellar disk shell orientation was found. Only little variability in apparent magnitude on the time scale of days exists, but long-term variability is common. In the Taurus region and in NGC 2264 two stars are especially unusual: Ry Tau shows strong, time-variable polarization increasing strongly toward the ultraviolet; and W90, situated below the main sequence in NGC 2264, shows variability in apparent magnitude as well as amount and wavelength dependence of polarization. The new data are interpreted as indicating variations in the optical depth of the circumstellar shell. (auth)

10711 NGC 2287 AND THE PLEIADES GROUP. Eggen, O.J. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, The Australian National University). Astrophys. J. 188: No. 1, 59-70 (15 Feb 1974).

Intermediate-band photometry in NGC 2516 and intermediate and broad-band photometry in NGC 2287 are presented. A preliminary luminosity calibration for early-type stars based on (β, [u-b]) is discussed and applied to both the brighter members of cluster stars in the Pleiades group and the field group members isolated by a survey of the kinematics of all bright $V_0\leq5.0$) B-type stars. A composite (M_{bol}, log T_e) -diagram is constructed for the group members and the distributions of the stars in the (X,Z) and (X,Y) planes are briefly discussed. (auth)

10712 THE ENERGY DISTRIBUTION OF THE VERY RED STAR IN NGC 6231. Schild, R. (Smithsonian Astrophysical Observatory); Oke, J.B.; Searle, L. Astrophys. J. 188: No. 1, 71-74 (15 Feb 1974).

From multichannel spectrometer data and infrared observations, the energy distribution of NGC 6231-92 is compared to model stellar atmospheres. The data are consistent with models hotter than $T_{eff}=6000$°K when the standard reddening law for Perseus is applied. Lower temperature models and the Johnson reddening curve for Scorpio-Centaurus cluster members do not fit the measured energy distribution. Nine new UBV photometric observations and infrared observations made in 1969 , 1970, and 1972 contain no evidence of variability. The new results support Herbig's suggestion that the star is a heavily reddened F supergiant behind NGC 6231. (auth)

10713 FREE-FREE AND FREE-BOUND EMISSION IN LOW-SURFACE-GRAVITY STARS. Gilman, R.C. (School of Physics and Astronomy, University of Minnesota, Minneapolis). Astrophys. J. 188: No. 1, 87-94 (15 Feb 1974).

The energy distributions of four cool supergiants, HD 97671, S Per, VX Sgr, and VY CMa, have been fitted using the emission spectra of the H^- ion, of ionic free-free scattering, and of pure magnesium silicate grains, as well as an underlying stellar blackbody. Densities and temperatures in the emission region were derived on the basis of these fits. The results are satisfactory except in the case of VY CMa, whose mid-infrared excess is probably due to emission from some nonsilicate grain. (auth)

10714 INFRARED VARIABILITY OF V1016 CYGNI. Harvey, P.M. (George W. Downs Laboratory of Physics, California Institute of Technology). Astrophys. J. 188: No. 1, 95-96 (15 Feb 1974).

The infrared flux variations of V1016 Cyg are similar to those of Mira variables and possibly suggest the presence of a late M component in V1016 Cyg. (auth)

10715 THE OXYGEN ABUNDANCE IN THE METAL-DEFICIENT STAR HD 122563. Lambert, D.L.; Sneden, C.; Ries, L.M. (McDonald Observatory and Department of Astronomy, University of Texas, Austin, Texas 78712). Astrophys. J. 188: No. 1, 97-100 (15 Feb 1974).

The forbidden neutral oxygen line at 6300.3 Å has been detected in the spectrum of the metal-deficient star HD 122563. The [O I] equivalent width, $W_\lambda = 6.0 \pm 1.0$ mÅ, and a model-atmosphere analysis provide an oxygen abundance log [N(O)/N(H)] = -5.38 ± 0.15 or a logarithmic overabundance of oxygen relative to the metals of [O/Fe] = +0.6. This relative overabundance of oxygen may be common to other metal-deficient stars. The probable role of convective mixing in altering the surface composition of evolved metal-deficient stars is pointed out. (auth)

10716 POLARIZATION BY ROTATIONALLY DISTORTED ELECTRON SCATTERING ATMOSPHERES. Cassinelli, J.P.; Haisch, B.M. (Washburn Observatory, University of Wisconsin-Madison). Astrophys. J. 188: No. 1, 101-104 (15 Feb 1974).

The polarization to be expected from rotationally distorted early-type stars is determined using results of calculations of the transfer of linearly polarized light in extended atmospheres. Polarization as high as about 6 percent is found for a disk envelope model and 2 percent for a Roche atmospheric model. The factors controlling the direction of the polarization are discussed. Plausible explanations are offered for the anomalous wavelength dependence of both the degree of polarization in the Wolf-Rayet star HD 50896 and of the direction of polarization in the Be star HD 45677. (auth)

10717 LINE ^{57}Co GAMMA RAYS: NEW DIAGNOSTIC OF SUPERNOVA STRUCTURE. Clayton, D.D. (Department of Space Physics and Astronomy, Rice University, Houston, Texas 77001). Astrophys. J. 188: No. 1, 155-157 (15 Feb 1974).

The nuclear gamma-ray lines emitted when ^{57}Co decays to ^{57}Fe should be detectable for several years following Galactic supernovae, and the time structure of their intensity relative to those emitted following the ^{56}Ni and ^{56}Co decays can reveal the structure of the exploding star. An analysis of a simplified analytic model is presented as an example.) (auth)

10718 PHOTOELECTRIC AND SPECTROSCOPIC OBSERVATIONS OF WRA 795. Vidal, N.V.; Wickramasinghe, D.T.; Peterson, B.A.; Bessel, M.S. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian National University). Astrophys. J. 188: No. 1, 163-165 (15 Feb 1974).

Photoelectric and spectroscopic observations of WRA 795 are presented. Light variations with a period of about 4 hours are revealed. The spectra also show variations in emission at Hα, Hβ, and Hγ and possibly in the strength of some absorption lines in time scales of half an hour. (auth)

10719 STELLAR SPECTRAL SYNTHESIS IN THE ULTRAVIOLET. Kurucz, R.L. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory, Cambridge, Massachusetts 02138). Astrophys. J. Lett. 188: No. 1, L21-L22 (15 Feb 1974).

A computer program for spectral synthesis has been developed, based on a list of data for atomic lines described by Kurucz, Peytremann, and Avrett. To demonstrate the usefulness of this program, we present a sample calculation of the region around the C IV resonance doublet at 155 nm, which is a feature in rocket and satellite spectra of B stars. The calculation indicates that the observed feature is a blend of many lines in addition to C IV, so that detailed calculations are necessary for the correct interpretation of the observational data. (auth)

10720 GAMMA-RAY LINES FROM NOVAE. Clayton, D.D.; Hoyle, F. (Department of Space Physics and Astronomy, Rice University). Astrophys. J. Lett. 187: No. 3, L101-L104 (1 Feb 1974).

Nova explosions may be accompanied by detectable levels of radioactivity. Positron annihilation and nuclear de-excitation following decays of ^{13}N, ^{14}O, ^{15}O, and ^{22}Na lead to gamma-ray line fluxes whose measurement will clarify the model. (auth)

10721 DISCOVERY OF TIME-VARYING CIRCULAR AND LINEAR POLARIZATION IN THE WHITE-DWARF SUSPECT GD 229. Swedlund, J.B. (Battelle Observatory, Battelle-Northwest, Richland, Washington 99352); Wolstencroft, R.D.; Michalsky, J.J. Jr.; Kemp, J.C. Astrophys. J. Lett. 187: No. 3, L121-L124 (1 Feb 1974).

Both circular and linear polarization have been found in the white-dwarf suspect GD 229. Both appear to change with time over periods of a few minutes and of about one day. No definite periodicities have been identified. In broadband measurements, sign changes of the circular polarization are seen in the red, but not in the blue. (auth)

10722 A SEARCH FOR LYMAN-ALPHA EMISSION IN BETA LYRAE FROM COPERNICUS. Kondo, Y. (Astrophysics Section (TN23), NASA Johnson Space Center, Houston, Texas 77058); McCluskey, G.E. Jr. Astrophys. J. Lett. 188: No. 2, L63-L65 (1 Mar 1974).

High-resolution (0.2 Å) spectrophotometric observations of the complex eclipsing binary β Lyrae were obtained with the Princeton Telescope Spectrometer on the Copernicus satellite. We discuss the search for Lα emission in β Lyrae and compare the Copernicus results with the OAO-2 observations of the same binary system. The possible Lα emission features observed from OAO-2 are identified as blends of the emission lines of other elements in the vicinity of Lα. (auth)

10723 PERIOD VARIATION OF THE CEPHEID ZETA GEMINORUM. Abt, H.A.; Levy, S.G. (Kitt Peak National Observatory, Tucson, Arizona). Astrophys. J. Lett. 188: No. 2, L75-L77 (1 Mar 1974).

In anticipation of the coming lunar occultations of ζ Gem on 1974 March 4 and 31, we derive a new ephemeris based on 70 years of radial-velocity measurements. The phases at the two occultations are predicted to be 0.96 and 0.65 phases, respectively, after light maximum. The period decreases at a steady rate of 3".1 per year, which is 4 times the evolutionary rate for a 7 $M_\odot$ Cepheid in the fundamental mode. However, it is also possible that the period decrease is due to a light-time effect in a long-period (>225 years) binary having a low-mass secondary. (auth)

10724 COHERENT NEUTRINO SCATTERING AND STELLAR COLLAPSE. Wilson, J.R. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. Lett. 32: No. 15, 849-852 (15 Apr 1974).

Freedman has shown that coherency and the neutral current theory of neutrinos imply a scattering cross section for neutrinos off heavy nuclei proportional to the square of the atomic weight. The collapse of an iron-core star produces a hot neutron star surrounded by a thin iron layer. Because of the large scattering rate in the outer layer, neutrinos from the hot neutron core are able to accelerate the iron layer to above escape velocity. (auth)

10725 LEE AND YANG VECTOR FIELD IN GRAVITATIONAL COLLAPSE. Tennakone, K. (Univ. of Sri Lanka, Nugegoda, Ceylon). Lett. Nuovo Cim.; 10: No. 5, 177-178(1 Jun 1974).

It was suggested by Lee and Yang that, associated with baryon conservation, there may exist a gauge-invariant vector field analogous to the electromagnetic field. It is shown that, since matter (not antimatter) is dominant in the Universe at least locally, the existence of the Lee and Yang interaction however weak it may be, could prevent the formation of a point singularity in gravitational collapse. (LBS)

10726 LIGHT AND COLOR CURVES OF CEPHEIDS IN THREE RED GLOBULAR CLUSTERS OF THE LARGE MAGELLANIC CLOUD. Demers, S. (Laurentian Univ., Sudbury, Ont.). Astron. J.; 78: No. 6, 461-466(Aug 1973).

B and V photographic photometry of seven Cepheids in NGC 1751, NGC 1953, and NGC 2121 is presented. The plates are calibrated with photoelectric sequences near each cluster. The mean apparent magnitudes of these variables follow the period-luminosity relation of classical Cepheids in the Large Magellanic Cloud. Their mean colors are comparable to mean colors of classical Cepheids. It is then concluded that these variables are most probably not Population II Cepheids like the ones found in globular clusters of the Galaxy. (auth)

10727 SEARCH FOR OH/IR STARS IN GLOBULAR CLUSTERS. Knapp, G. R.; Kerr, F. J. (Univ. of Maryland, College Park). Astron. J.; 78: No. 6, 458-460(Aug 1973).

Sixteen globular clusters were observed in the 1612-MHz line of OH in a search for maser-line emission from possible infrared stars in the clusters. No such emission was found. This result is discussed from the point of view of stellar evolution and the heavy element abundances in globular cluster. (auth)

10728 LUMINOSITY DISCRIMINANT FOR RED GIANTS AND SUPERGIANTS. Sharpless, S. (Univ. of Rochester, NY); Wawrukiewicz, A. S. Astron. J.; 78: No. 6, 477-481(Aug 1973).

This paper is the second in a series devoted to a photoelectric technique for the determination of distances of late-type supergiants. A luminosity discriminant is described which allows the separation of late-type giants and supergiants. Twenty MK standards and 36 red luminosity class I and II stars have been used to calibrate the discriminant, an index based on the cyanogen features at 7935 Å. The CN index allows ready separation of all K4-M2.6 and many M2.6-4.5 giants and supergiants, when used in conjunction with the TiO index discussed in the first paper. In addition to the ability to clearly separate most late-type giants and supergiants there is some evidence that the CN discriminant may also be able to distinguish among the supergiant luminosity classes. (auth)

10729 LIST OF ADDITIONAL VARIABLE STARS IN THE TWO-MICRON SKY SURVEY. Lockwood, G. W.; Zinter, T. A.

(Kitt Peak National Observatory, Tucson, AZ). Astron. J.; 78: No. 6, 471-477(Aug 1973).

Two hundred-thirty stars previously unidentified or misidentified in the Two-Micron Sky Survey were identified with stars in the General Catalogue of Variable Stars (3d edition), the First Supplement to the Third Edition of the General Catalogue of Variable Stars, or the Catalogue of Suspected Variable Stars. (auth)

10730 FOUR RR LYRAE-TYPE VARIABLE STARS NEAR THE SOUTH GALACTIC POLE. Graham, J. A. (Cerro Tololo Inter-American Observatory, La Serena, Chile). Astron. J.; 78: No. 6, 468-470(Aug 1973).

Visual magnitudes are presented for four variable stars of the RR Lyrae type near the South Galactic Pole. These observations are used to determine the period and light curve for each star. (auth)

10731 PHOTOMETRIC OBSERVATIONS OF DELTA SCUTI STARS I HR 8006, HR 9039. Le Contel, J. M. (Observatoire de Nice); Valtier, J. C.; Sareyan, J. P.; Baglin, A.; Zribi, G. Astron. Astrophys., Suppl. Ser.; 15: No. 1, 115-132(Apr 1974).

The first results of an observational program on short-period variable stars are presented. The main characteristics of the equipment, especially optimized for precise differential photoelectric photometry are described. Light curves of the δ Scuti star HR 8006 are presented; they display wide changes in shape and amplitude. The values obtained for the period show a large scatter from night to night. Detection has been performed successfully on HR 9039 (82 PEG) which is a new δ Scuti type star of very small amplitude in light variations. An estimated period of 0.06 day is derived from the observations. The complexity of the light curve in most δ Scuti stars is emphasized. It is proposed to attribute this complexity to nonlinear atmospheric effects, and not to a mixture of harmonic modes of oscillations. (auth)

10732 NUCLEAR ASTROPHYSICS. Audouze, J.; Vauclair, S. Paris; Presses Universitaires (1972). 128p. (In French).

Nuclear astrophysics explains the origin of the energy stored in the Sun and stars and the evolution of these astral bodies. It also explains the origin of the world's chemical elements. A definition is given of fusion reactions between charged particles, explosive reactions in stars, neutron absorption reactions, the creation of Li, Be, and B, cosmic radiations, neutron stars, and abnormally chemically composed stars. (auth)

10733 LIGHT CURVE (m_{pg}) of HR DEL (NOVA DELPHINI 1967). Terzan, A. (Observatoire de Lyon, Saint-Genis-Laval, France); Bally, M.; Durand, A. Astron. Astrophys., Suppl. Ser.; 15: No. 1, 107-113(Apr 1974).

The light curve (m_{pg}) of HR Del is drawn for the period going from July 10, 1967 to November 5, 1972. During the phase of decline—which began in December 1967—the decrease of brightness was particularly slow. In September 1971, there was a sudden fall of brightness of about 0.7 m_{pg}. Then in November 1971, the star had again the magnitude $m_{pg} \sim 10.2$. At the end of 1972, the photographic magnitude of the nova was 10.59. (auth)

10734 RGU, PHOTOMETRY OF THE OPEN CLUSTERS NGC 581 (= M 103), Tr 1, AND NGC 659. Steppe, H. (Univ., Basel). Astron. Astrophys., Suppl. Ser.; 15: No. 1, 91-105(Apr 1974).

By means of RGU three-color photographic photometry the open clusters NGC 581 (= M 103), Tr 1, and NGC 659 were investigated. The distance of NGC 581 is found to be 3110 pc and the reddening E(G−R) = 0.62m. The distance for Tr 1 is 2980 pc and the reddening E(G−R) = 0.85m. NGC 659 has a distance of 2280 pc and a reddening of E(G−R) = 0.88m. All three clusters are young spiral arm indicators. (auth)

10735 SPECTRAL ENERGY DISTRIBUTIONS OF T TAURI STARS. Kuhi, L. V. (Inst. of Astrophysics, Paris). Astron. Astrophys., Suppl. Ser.; 15: No. 1, 47-89(Apr 1974).

The spectral energy distributions of T Tauri stars and related objects have been measured with a photoelectric spectrum scanner from 0.33 to 1.11 μ. Reddening corrections derived from the spectral types show an increase towards earlier type presumably due to the presence of circumstellar material. This in turn provides qualitative support for Larson's evolutionary scheme for stars of low mass ($\lesssim 2\ M_\odot$) with an age of $\lesssim 8 \times 10^5$ years for the Tarsus association. The corrected energy distributions indicate clearly the peculiar nature of the ultraviolet and blue continuous emission from T Tauri stars. Emission-line fluxes are also measured for the brighter hydrogen, calcium, and helium lines. A strong correlation is found between the ultraviolet flux and the Ca II K emission and indicates a chromospheric origin for the various emission phenomena. (auth)

10736 SPACE VELOCITIES OF NEARBY CLASSICAL CEPHEIDS. Wielen, R. (Astronomisches Rechen Institut, Heidelberg). Astron. Astrophys., Suppl. Ser.; 15: No. 1, 1-33(Apr 1974).

The space velocities of the 45 classical Cepheids with distances $r \leqq 1$ kpc are derived and discussed. Only 12 nearby Cepheids have reliable individual space velocities (mean error $\leqq \pm 8$ kms^{-1}). The velocity distribution of the nearby Cepheids reveals no obvious systematic behavior of the peculiar velocities. The mean motion of the nearby Cepheids with respect to the Sun is found to be $\langle U \rangle = -11$ kms^{-1}, $\langle V \rangle = -12$ kms^{-1}, $\langle W \rangle = -10$ kms^{-1}, with a mean error of ± 2 kms^{-1}. Hence the average motion of the nearby Cepheids in the galactic plane does not differ significantly from the commonly adopted circular velocity of galactic rotation. The velocity dispersion in U, V, and W is ± 8 kms^{-1}, ± 7 kms^{-1} and ± 5 kms^{-1}, respectively. The kinematical data of the nearby Cepheids confirm the distance scale of classical Cepheids based on cluster members, since the method of secular parallaxes yields only an insignificant decrease of the distances by $-10\% \pm 20\%$ (m.e.). (auth)

10737 OBSERVATIONS OF FIVE SUPERNOVAE 1970−1971. Barbon, R.; Ciatti, F.; Rosino, L. (Osservtorio Astrofisico, Asiago, Italy). Soc. Astron. Ital., Mem.; 44: 65-85(1973).

A description is given of photographic observations of the supernovas 1970-j, 1970-l, 1971-g, 1971-i, and 1971-l carried out during 1970 and 1971 at the Asiago Observatory. Tables and graphs illustrate the light and color curves and magnitudes of these objects. On the basis of the B and V light curves and spectra, it is concluded that all the supernovas probably belong to Type I. (IAA)

10738 EQUIVALENT WIDTH OF CH LINE IN ETA AQUILAE. Joshi, G. C.; Bondal, K. R.; Pande, M. C. (Uttar Pradesh State Observatory, Naini Tal, India). Bull. Astron. Inst. Czech.; 25: No. 2, 120-121(1974).

Equivalent widths of a line belonging to the 0−0 bands of the electronic transition $^2\Delta - {}^2\Pi$ of the CH molecule were calculated for various phases of light variation in η Aql. For the spectral class of η Aql the equivalent widths are found to be rather small. (auth)

10739 ORBITAL ELEMENTS OF THE SPECTROSCOPIC BINARY HD 92168. Ginestet, N.; Pedoussat, A.; Carquillat, J. M.; Nadal, R. (Observatoires du Pic du Midi, Toulouse). Astron. Astrophys., Suppl. Ser.; 15: No. 2, 133-139(May 1974). (In French).

HD 92168 was indicated as a spectroscopic binary in Wilson's Catalogue (1953). Two series of recent observations (Observatoire de Haute-Provence), associated with first observations (Wilson and Victoria Observatories), gave the orbital elements of this binary for the first time. The secondary component would be a dM star; the separation of components would be near 20 $R_\odot$. (auth)

10740 V 453 CYG: AN EARLY TYPE ALGOL BINARY. Cohen, H. L. (Univ. of Florida, Gainesville). Astron. Astrophys., Suppl. Ser.; 15: No. 2, 181-208(May 1974).

Approximately 539 photoelectric UBV observations of the massive, double-line eclipsing binary V 453 Cyg (B0.5IV + B0.5IV) were obtained at Lowell Observatory in 1966. The observations show that (1) the system is Algol-type, (2) perturbations of the light curve are small, (3) the eclipses are complete with nearly equal depths (0.41m and 0.37m) and nearly flat bottoms, (4) orbital eccentricity effects are obvious only for e cos ω, and (5) (B−V) and (U−B) are constant at +0.19m and −0.68m respectively. Analysis of the light curve is complicated by small unexplained brightness difference (0.026m) between the June−July and August−October observations. Preliminary elements, however, should be realistic estimates of system parameters. Secondary minimum is shown to be the total occultation. A consistent set of geometrical elements fits both eclipses in all colors. The ratio of radii and orbital inclination are fixed near 0.61 and 85° respectively. Available spectroscopic data and membership in NGC 6871 can be used to estimate absolute dimensions and magnitudes. The system appears to be composed of two almost spherical stars of nearly identical surface temperatures. The slightly hotter component is, however, more massive and larger. V 453 Cyg is a distinctly detached system with components near the main sequence turn-off of NGC 6871. (auth)

10741 SPACE DISTRIBUTION OF M GIANTS IN THE WARNER AND SWASEY LUMINOSITY FUNCTION FIELD LF 15. The, P. S.; Staller, R. F. A.; Meurs, E. J. A. (Univ. of Amsterdam). Astron. Astrophys., Suppl. Ser.; 15: No. 2, 141-171(May 1974).

A rectangular field of 3° × 2° centered on the open cluster NGC 6067 in the Warner and Swasey Luminosity Function field LF 15 was surveyed for M−type stars. The survey goes to a limiting infrared magnitude of about 12.5. The mean infrared absorption in the field was studied using data of M2, M3, and M4 stars and those published by Drilling (1968). It increases gradually up to

about 1.5 infrared magnitude at a distance of 5 kpc. Space densities were computed for the M2–M4, M5–M6.5, and M7–M9 groups using Schalen's method. The first group seems to be more connected to the Sagittarius arm, as delineated by optical spiral tracers, then the other two groups. (auth)

10742 PHOTOELECTRIC PHOTOMETRY OF SHELL STARS. Haupt, H. F.; Schroll, A. (Universitats-Sternwarte, Graz). Astron. Astrophys., Suppl. Ser.; 15: No. 2, 311-319(May 1974). (In German).

Stars showing shell phenomena were suspected of indicating active phases by light variations that are more easily measured than their spectra. Therefore 83 shell stars and carefully selected comparison stars have been observed during 1968/69 at the Vienna University Observatory and at Observatoire de Haute-Provence (OHP). Table 1 which is rather self-explanatory contains the final results. A magnitude or color difference in the remark column is in the sense shell minus comparison star. Table 2 shows the results for the standard stars, where the mean error of one observation is about ±0.03m for V and U–B, and about ±0.02m for B–V. Figure 1 shows the mean errors according to their frequency for shell and comparison stars observed in 1969. Some stars seem to show variability in the observing period. By comparing these measures to the ones of Mendoza, Hiltner, and Iriarte it is found that about 40% of the stars show a change in magnitude of more than ±0.08m. The two color diagram indicates that most of the stars show considerable reddening, that could be of interstellar or/and circumstellar origin. Three extremely reddened stars, namely HD 161114 = XXOph, HD 169226, BD + 14° 3887, are discussed. (auth)

10743 COLOR - MAGNITUDE DIAGRAMS FOR ELEVEN YOUNG CLUSTERS IN THE MAGELLANIC CLOUDS. Robertson, J. W. (Australian Univ., Canberra). Astron. Astrophys., Suppl. Ser.; 15: No. 2, 261-309(May 1974).

Photographic B and V observations are presented for 1 SMC and 10 LMC clusters. The color–magnitude diagrams for these clusters show fairly tight groups of red and blue giants in the mass range 5 to 25 $M_{\odot}$. (auth)

10744 TOTAL ALPHA-INDUCED CROSS SECTIONS IN STELLAR NUCLEOSYNTHESIS. Vlieks, A. E. Columbus, OH; Ohio State Univ. (1973). 164p. University Microfilms Order No. 74-3338.

Thesis (Ph. D.).

Total alpha induced reaction cross sections have been evaluated for the $^{46}Ti(\alpha,n)$, $^{56}Ni(\alpha,p)$, $^{50}Cr(\alpha,n)$, $^{54}Fe(\alpha,n)$ $^{45}Sc(\alpha,n)$ and $^{51}V(\alpha,n)$ reactions from threshold energies to 11 MeV. The cross-sectional determinations for five of the reactions were made by measuring the annihilation γ rays from the product nucleus which decayed by positron emission. The cross section for the $^{51}V(\alpha,n)$ reaction was determined by measuring the x rays emitted from the decaying product nucleus as a result of electron capture. For these cross sections, stellar reaction rates have been calculated, in the temperature region of $1 \leq T_9 \leq 5$, and a comparison with the theoretical predictions of Truran has been made. A discussion is presented concerning the reliability of using laboratory cross-sections, where the target nucleus is in the ground state, for reactions within a star where low-lying excited states could be populated in a thermal equilibrium with the ground state. Included also is a functional form, suggested by Fowler, which can be used to describe the reaction rates within the temperature range $1 \leq T_9 \leq 5$ and which agrees with the calculated reaction rates at the discrete temperatures where the reaction rates have been evaluated. (Diss. Abstr. Int., B)

10745 ULTRAVIOLET PHOTOMETRY FROM THE ORBITING ASTRONOMICAL OBSERVATORY. XI. THE 1971 ECLIPSE OF 32 CYGNI. Doherty, L.R.; McNall, J.F.; Holm, A.V. (Space Astronomy Laboratory, Washburn Observatory, University of Wisconsin, Madison). Astrophys. J. 187: No. 3, 521-530 (1 Feb 1974).

We observed the 1971 eclipse of 32 Cyg at regular intervals from November 1 to 15 with the wide-band filter photometers aboard OAO-2. Data have been reduced for seven filter bands with effective wavelengths between 4250 and 1430 Å. Both the constancy of the light near mid-eclipse for the shorter wavelengths, and the derived energy distribution of the B component over all of these wavelengths indicate that the eclipse was total. The spectral types determined from the photometry of the two components are B5 and K4 Ib, after correction for interstellar reddening of 0.10 mag in B–V. The duration of totality increased with decreasing wavelength down to 2460 Å. At shorter wavelengths, totality persisted for times at least as great at 2460 Å. Although our observations cover only part of egress, the shapes of the light curves beyond fourth contact show that the opacity, k_{ν}, extends to great distances from the K star in the ultraviolet. For the 2460 Å band, the opacity falls off no less rapidly than r^{-2}. It is possible that the opacity at 1430 Å has a similar extent. During totality, the observed 2460 Å radiation was 2 mag brighter than expected for a normal K supergiant. Excess radiation was also observed in the 1550 and 1430 Å bands. A possible origin of this excess is emission in the extended K atmosphere due to recombination of Mg and Si ions. (auth)

10746 ON THE PROBLEM OF V1016 CYGNI AND THE EVOLUTIONARY STAGE OF THE SYMBIOTIC STARS. Baratta, G.B.; Cassatella, A. (Osservatorio Astronomico, Roma); Viotti, R. Astrophys. J. 187: No. 3, 651-660 (1 Feb 1974).

A spectrophotometric study of V1016 Cygni (=MH_{α} 328–116) has been carried out using several objective-prism spectra taken during 1971–1972, covering the spectral range 3425–9000 Å. No spectral variations have been detected during this period, which indicates that this object has reached a stationary phase. The optical continuum is in agreement with that measured by O'Dell in 1965–1966. Special attention was paid to the optical and infrared energy distribution of V1016 Cyg, and to the comparison with two other strong infrared sources, V1329 Cyg (=HBV 475) and η Carinae. It is shown that the recent history of V1016 Cyg can be best represented by a model of an evolved star surrounded by a large gas and dust envelope of few hundredths of a solar mass. Before the 1964 outburst the star should have presented a cool atmosphere which was pushed out during the active phase. It is concluded that the phenomenon of the symbiotic stars could be interpreted as a manifestation of advanced stages of a very late star. (auth)

10747 OAO-2 OBSERVATIONS OF THE HELIUM SPECTRUM VARIABLE a CENTAURI. Molnar, M.R. (Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder). Astrophys. J. 187: No. 3, 531-538 (1 Feb 1974).

Ultraviolet photometry and spectrometer data are presented for a Cen, which exhibits large variations in the strength of its He I lines. The photometry indicates that the star becomes brighter at the helium-weak phase by 0.05 mag throughout the ultraviolet and visual region. A model atmosphere analysis indicates that the photometric variations are not due to flux redistribution from back-warming effects, but can be interpreted as due to the rotation of a distorted stellar disk in the shape of a prolate spheroid. (auth)

10748 SPECTROSCOPIC STUDIES OF O-TYPE STARS. IV. LINES IN THE RED REGION. Conti, P.S. (Joint Institute for Laboratory Astrophysics, University of Colorado, Boulder). Astrophys. J. 187: No. 3, 539-550 (1 Feb 1974).

Equivalent widths of severals lines in the red spectral region have been obtained for 77 O and Of type stars. The spectroscopic material of 16A mm^{-1} dispersion, in some cases using a fiber-optics image tube, was obtained at the Lick Observatory 120-inch (3-m) coudé. Comparison with the non-LTE plane-parallel models of Auer and Mihalas has been made. The stengths of the lines λ6678 He I and λ5411 He II are in good agreement with their models for most stars. For main-sequence stars the line λ5876 He I is about 30 percent stronger than predicted and is even more discrepant for supergiants. This is most likely due to the effect of microturbulence which has not been included in the models. For main-sequence stars there is good agreement between the observations and the models for Hα. For many luminous stars this line has a P Cygni profile or is strongly in emission. There is a good correlation between these extended-atmosphere effects for Hα and for λ4686 He II. Runs of observed equivalent width with spectral type for λ5801 C IV and λ5592 O III are also presented. There is evidence that some supergiant stars have excessively strong C IV lines, in agreement with the OC classifications of Walborn. There is also strong evidence that these lines are variable in at least one case. (auth)

10749 ON THE ABUNDANCE OF EUROPIUM. Hartoog, M.R.; Cowley, C.R. (University of Michigan, Ann Arbor); Adelman, S.J. Astrophys. J. 187: No. 3, 551-554 (1 Feb 1974).

The inclusion of the effects of hyperfine splitting can significantly lower the abundance estimate of Eu from singly ionized lines which lie on the flat portion of the curve of growth. In the 21 cool Ap stars studied by Adelman and the five Am stars studied by Smith the Eu abundance was reduced by 0.4 dex on the average. In individual cases the reductions were as great as 0.9 dex. This makes the Eu abundance comparable to that of its neighboring rare earths Sm and Gd in the Ap stars and less than Sm and Gd in the Am stars, but still substantially overabundant with respect to solar values. (auth)

10750 CARBON AND ERUPTIVE STARS: SURFACE ENRICHMENT OF LITHIUM, CARBON, NITROGEN, AND ^{13}C BY DEEP MIXING. Sackmann, I.; Smith, R.L.; Despain, K.H. (California Institute of Technology). Astrophys. J. 187: No. 3, 555-574 (1 Feb 1974).

It appears possible to form carbon stars of both low ($\sim 1\ M_{\odot}$) and intermediate ($\sim 5\ M_{\odot}$) masses and from both population types. A single helium shell flash followed by deep mixing suffices for the former case, but on the order of 100 such flashes are required for the latter. No more than the order of 100 flashes are possible for the former and 1000 for the latter. The Cameron–Fowler mechanism for the production

of high lithium abundances in late-type stars is shown to work satisfactorily, producting $^7Li/H$ up to about 10^{-7} in a single flash. This value is nearly independent of mass and population type. Eruptive stars may result when the deep convective envelopes reach into helium-burning layers. Large amounts of energy can be liberated in a very short time; e.g., the binding energy of the envelope, 10^{48} ergs, can be exceeded in $\sim 10^6$ sec. Many of the gross features of the R Coronae Borealis stars can be understood by erupting carbon star models. For example, observed surface abundances of H, He, ^7Li, $^{12}C/^{16}O$, $^{14}N/^{12}C$, and $^{12}C/^{13}C$ can be accounted for. For an unrepeated deep mixing, an upper limit can be placed on the mass of a carbon star, namely, $\sim 2\ M_\odot$. For short-duration mixing, $^7Li/H$ reaches its peak values ($^7Li/H \simeq 10^{-7}$), $^{12}C/^{16}O > 1$ or < 1, depending on the mass, $10^{-3} < {}^{14}N/{}^{12}C < 1$, and $5 < {}^{12}C/{}^{13}C < 100$; for intermediate-duration mixing, $^7Li/H < 10^{-8}$, $^{12}C/^{16}O < 1$, $1 < {}^{14}N/{}^{12}C < 40$, and $2.4 < {}^{12}C/{}^{13}C < 5$; for long-duration mixing, $^7Li/H = 0$, $^{12}C/^{16}O > 1$, $^{14}N/^{12}C = 40$, and $^{12}C/^{13}C = 3.2$. These abundance ratios agree quite well with the observations in the oxygen and carbon stars, S, Ba II, C, and CH, ordering these spectral types in a sequence determined by the duration of deep mixing. Repeated deep mixing can explain the observations known for S, Ba II, and C stars when they are considered to be intermediate-mass objects. S stars would be interpreted as those with few flashes, Ba II stars as those with an intermediate number of flashes, and C stars super-rich in ^7Li as those with a very large number of flashes. (auth)

10751 TIME VARIATION OF THE H_2O MASER AND INFRARED CONTINUUM IN LATE-TYPE STARS. Schwartz, P.R. (E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D.C.); Harvey, P.M.; Barrett, A.H. Astrophys. J. 187: No. 3, 491-496 (1 Feb 1974).

Time variations in the microwave H_2O emission from late-type stars are shown to be periodic and are correlated with optical and infrared variations. The microwave variability may result from changes in the maser pump rate induced by changes in the infrared flux. (auth)

10752 ROTATING MAGNETOSPHERE: FAR-FIELD SOLUTIONS. Michel, F.C. (Department of Space Physics and Astronomy, Rice University, Houston, Texas 77001). Astrophys. J. 187: No. 3, 585-588 (1 Feb 1974).

General principles are established for the solution of the distant magnetic field structure about a rotating axisymmetrically magnetized object surrounded by plasma of negligible inertia. These principles are applied to the interesting case of a dipole magnetic field (as well as the monopole case) and can readily be extended to any other axisymmetric multipole. Analytic solutions are shown, and we thereby compute relevant physical quantities (charge density, magnetic field intensity, torque, etc.). The result, that the magnetic field lines form a perfect universal Archimedean spiral according to the relationship $\tan \xi = \omega\rho/c$, is found to be general and applies to all axisymmetric multipoles in the zero inertia limit. In the above equation, ξ is the angular deviation of the field line from radial, ω is the rotation rate, ρ is the distance from the rotation axis, and c is the velocity of light. Also general, the flow velocity is everywhere purely radial and equal to c. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 10584, 10586–10588, 10644, 10686, 10708, and 10709.

10753 (CONF-730804-P1, pp 56-59) RAPID CHANGE IN THE LOW ENERGY CUT-OFF OF SCORPIUS X-1. Moore, W. E.; Cordova, F.; Garmire, G. P. (California Inst. of Tech., Pasadena). 1973.

From 13th International cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The medium attenuating the low energy x-ray flux from Scorpius X-1 has apparently changed by more than 40 percent on a time scale of less than 45 seconds. (auth)

10754 (CONF-730804-P1, pp 61-66) BALLOON OBSERVATIONS OF CELESTIAL X RAYS. Part I. X-Ray Emission from Cyg X-1 at Energies Greater Than 20 keV. Jain, A. K.; Jayanthi, U. R.; Sharma, D. P.; Kasturirangan, K.; Rao, U. R. (Physical Research Lab., Ahmedabad, India). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Two balloon flights were made from Hyderabad, India, using scintillation telescopes mounted on an oriented platform that made observations on Cyg X-1 in the energy range 20 to 150 keV. The detector was a NaI(Tl) crystal of 4 mm thickness having an effective area of 76 cm^2. The telescopic response was realized by using a graded shield collimator of lead, tin, and copper that defined a FWHM of 12° for x rays of energy less than 200 keV. Plastic anticoincidence shield was used in addition for eliminating charged-particle induced events. The first flight conducted on March 29, 1972 reached a ceiling altitude of 5.4 mbar and observations on Cyg X-1 were made for about an hour by tracking the source. The second flight carried out on Jan. 18, 1973 reached a residual atmospheric depth of 4.8 millibars and again observations on this source were made for more than 15 minutes. The paper presents the results of spectral information on Cyg X-1 derived from these flights. Further, temporal variation in flux and energy spectrum, both of long and short term nature, are discussed. (auth)

10755 (CONF-730804-P1, pp 67-71) BALLOON OBSERVATIONS OF CELESTIAL X RAYS. Sharma, D. P.; Jain, A. K.; Kasturirangan, K.; Jayanthi, U. B.; Rao, U. R. (Physical Research Lab., Ahmedabad, India). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The results are presented of two balloon flights in which an attempt was made to detect x-ray emission from Her X-1 in the energy interval 20 to 150 keV. The flights were conducted from Hyderabad, India, on December 28, 1972 and January 18, 1973 and reached floating depths of 5 millibars and 4.8 millibars respectively. The detector details are as outlined in the first part of the paper. At the time of first flight, Her X-1 was close to the peak of its bright phase as extrapolated from the Uhuru low-energy data assuming the period to be 35 days. The second flight was made during the dark phase and the data was analyzed to see the level of hard x-ray emission while there were no observable pulsations at lower energies. The results were examined in relation to those available at low energies from Uhuru data and the different features of emission of x radiation from Her X-1 are discussed. (auth)

10756 (CONF-730804-P1, pp 73-77) OBSERVATION OF X-RAY VARIATION IN CYGNUS X-1. Nakagawa, M. (Osaka City Univ.); Sakurai, H.; Kitamura, T. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A sudden increase in the x-ray intensity of Cyg X-1 was observed in a balloon flight on October 7, 1972, from Sanriku, Japan. The intensity rose to a maximum and decreased to an averaged flux in less than 25 min. The photon flux of the flare over the energy range 30 to 70 keV was $42.82 \pm 7.50 \times 10^{-2}$ photons cm^{-2} sec^{-1}. (auth)

10757 (CONF-730804-P1, pp 86-91) DISTANCE DETERMINATION OF VARIABLE X-RAY SOURCES BY OBSERVATIONS OF X-RAY SCATTERING BY INTERSTELLAR DUST. Scoenfelder, V. (Max-Planck-Institut fuer Physik, Garching, Ger.); Truemper, J. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Scattering on interstellar dust grains should lead to the formation of halos around discrete x-ray sources. In the case of variable objects time structures will be delayed and damped out in the halo due to round about ways. Since these effects depend essentially on the geometrical distance of the object the latter can be determined by studying the time history of the halo intensity. At the same time informations on the dust density distribution along the line of sight can be obtained. (auth)

10758 (CONF-730804-P1, pp 439-444) FIRST RESULTS OF A SOUTHERN HEMISPHERE SEARCH FOR GAMMA-RAY SOURCES AT $E \geq 3 \times 10^{11}$eV. Grindlay, J. E. (Harvard Observatory, Cambridge, MA); Brown, R. H.; Davis, J.; Allen, L. R. 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The optical intensity interferometer operated by Sydney University at Narrabri, NSW, Australia was converted in April 1972 to a sensitive detector of atmospheric Cherenkov light from EAS with $E_0 > 3 \times 10^{11}$ eV. Its two 7m aperture optical reflectors were separated by 120m and pointed by computer at the mean altitude for the maximum development of EAS from the direction of an object to be studied. Off-axis photomultipliers on one reflector viewed the atmospheric Cherenkov light from the EAS muon cores, thus enabling rejection of 40% of EAS detected as being cosmic-ray initiated. Possible ($\gtrsim 3\sigma$) sources were found in the directions of Cen A (NGC 5128), the Vela pulsar, and MP 1451

out of 11 candidate objects studied. Confirmation of these results will be attempted in an improved series of observations in April-May 1973. (auth)

10759 (CONF-730804-P1, pp 446-449) SURVEY OF GAMMA-RAY SOURCES IN THE GALACTIC PLANE AT ENERGIES OF 10^{11} TO 10^{12} eV. Weekes, T. C. (Smithsonian Astrophysical Observatory, Amado, AZ). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A number of discrete sources of gamma rays have been reported in the galactic plane from balloon and satellite experiments at energies of 100 MeV. Ground-based techniques with energy thresholds of 10^{12} eV have reported the detection of sources in Cygnus and Cassiopeia. Most of these sources have somewhat marginal statistical significance and have not been confirmed. The 10-m optical reflector at Mt. Hopkins, Arizona, has been used to detect atmospheric Cherenkov radiation from air showers whose primaries appear to come from the direction of these sources. The energy threshold for gamma rays is 10^{11} eV. No statistically significant results have been obtained from the direction of any of these sources; this could indicate that the original sources were statistical fluctuations, or that the sources are genuine and have an energy spectrum with a cutoff below 10^{11} eV, or that the sources are time variable. (auth)

10760 (CONF-730804-P1, pp 456-460) HIGH-ENERGY GAMMA-RAY OUTBURST IN THE DIRECTION OF THE X-RAY SOURCE Cyg X-3. Vladimirskii, B. M.; Stephenian, A. A.; Fomin, V. P. (Crimean Astrophysical Observatory, Crimea, USSR). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A search for high-energy gamma rays from Cyg X-3 using Cherenkov light pulses from EAS was made at the Crimean Astrophysical Observatory from September 5 till November 1. The arrangement consisted of two independent sections of the detectors. The data of one of the sections for September 8 and 9 showed a counting-rate excess from Cyg X-3 region. The two-night average excess was equal to $20 \pm 4\%$ which corresponded to the flux of $2 \cdot 10^{-10}$ quanta cm^{-2} sec^{-1} for the energy $\geq 10^{12}$ eV. The possibility of such random fluctuation was estimated using the T-test and was equal to $6 \cdot 10^{-4}$. There was no excess in the second section of the installation. The analysis of control data did not permit to suppose that this excess was connected with any meteorological effects or a failure. The energy threshold of the second section was 1.8 times higher than that of the first one. It was concluded that integral energy spectrum of the source's gamma-radiation has an index more than 3.2. (auth)

10761 (NP-20012) EQUATION OF STATE AT ULTRA HIGH DENSITIES. Canuto, V. (Niels Bohr Institutet, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1974. 152p. Dep. NTIS (US Sales Only) $10.75.

The current status of knowledge about matter at unusually high densities is reviewed. Densities in the range 10^6 to 10^{15} g cm^{-3} are considered. (WDM)

10762 (NP-20014) MECHANICAL PROPERTIES OF THE NEUTRON LATTICE IN PSR 0833-45. Jones, P. B. (Oxford Univ. (UK). Dept. of Nuclear Physics). 1973. 15p. Dep. NTIS (US Sales Only) $4.00.

The mechanical properties of a possible solid core in the pulsar PSR 0833-45 are examined in relation to the observed changes in period and their interpretation by Pines et al., (Nature Phys. Sci.; 237: 83 (1972)). Qualitative arguments based on known characteristics of solid ^{3}He and assuming a many-body Hamiltonian with non-directional two-particle potentials indicate that the neutron lattice should have a high value of Poisson's ratio and allow dislocation glide at low applied stresses. A possible explanation of the sudden failure of the core and the upper limit for the creep rate may be found in the quantum mechanical tunnelling model of dislocation intersection introduced by Mott (Phil. Mag.; 1: 568(1956)). The present oblateness parameter is estimated to be $\epsilon \lesssim 4 \times 10^{-4}$. It is predicted that the magnitude and frequency of period changes should decrease significantly in the remaining part of the century. (auth)

10763 EARLY EVOLUTION OF RADIO OUTBURSTS AND A POSSIBLE TRANSIENT EMISSION OF HIGH-ENERGY PHOTONS. Pacini, F. (Laboratorio di Astrofisica Spaziale, Frascati (Italy)Salvati, M. Astrophys. J. Lett. 188: No. 2, L55-L58 (1 Mar 1974).

We have investigated a model for radio outbursts assuming constant injection of fast particles and magnetic field. We discuss the expected spectral evolution, and we predict the existence of a related transient emission of high-energy photons. (auth)

10764 THE EVOLUTION OF THE RADIO SPECTRUM OF CASSIOPEIA A. Dent, W.A.; Aller, H.D.; Olsen, E.T. (Padio Astronomy Observatory, University of Michigan). Astrophys. J. Lett. 188: No. 1, L11-L13 (15 Feb 1974).

Measurements of the decay of Cas A at 8.0 GHz yield a rate of -0.70 ± 0.07 percent per year. A comparison with determinations at lower frequencies establishes that the decay rate is frequency dependent and that the radio spectrum of Cas A is becoming flatter with time. (auth)

10765 OPTICAL SPECTRA AND THE MASS OF SMC X-1. Osmer, P.S. (Cerro Tololo Inter-American Observatory); Hiltner, W.A. Astrophys. J. Lett. 188: No. 1, L5-L8 (15 Feb 1974).

Photographic spectra of Sanduleak 160 show 4686 emission with a large amplitude velocity variation ($\sim$260 km s^{-1}) that is approximately in phase with the X-ray object and evidence for an orbital motion up to 40 km s^{-1} of the primary itself. Analysis of the results gives a mass of near $2M_\odot$ for the X-ray object. The new data also provide additional constraints for models of the system. (auth)

10766 2U 0900-40: A BLACK HOLE?. Wickramasinghe, D.T.; Vidal, N.V.; Bessel, M.S.; Peterson, B.A.; Perry, M.E. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian National University). Astrophys. J. 188: No. 1, 167-172 (15 Feb 1974).

An analysis of the radial-velocity curve, spectrum, and reddening of HD 77581 indicates that its X-ray companion 2U 0900-40 has a mass $\gtrsim 3M_\odot$. As this mass is greater than that currently accepted for neutron stars, the companion may be a black hole. (auth)

10767 A HIGH-RESOLUTION MAP OF THE GALACTIC-CENTER REGION. Kapitzky, J.E.; Dent, W.A. (Department of Physics and Astronomy, University of Massachusetts, Amherst). Astrophys. J. 188: No. 1, 27-32 (15 Feb 1974).

The galactic-center region has been mapped at 15.5 GHz with an effective resolution of 2'.25. The greater sensitivity and resolution of this map over previous ones reveals that the region is extremely complex consisting of a large number of densely clustered discrete sources. (auth)

10768 A TEN-DAY OBSERVATION OF HERCULES X-1 FROM THE OSO-7 SATELLITE. McClintock, J.E.; Clark, G.W.; Lewin, W.H.G.; Schnopper, H.W.; Canizares, C.R.; Sprott, G.F. (Department of Physics and Center for Space Research, Massachusetts Institute of Technology, Cambridge). Astrophys. J. 188: No. 1, 159-162 (15 Feb 1974).

The MIT X-ray detectors aboard the OSO-7 spacecraft viewed Hercules X-1 from 1972 November 14 to November 24. X-ray turn-on in the 35-day cycle was observed to occur between phases 0.67 and 0.70 (November 18.64-18.70). A significant decrease in the X-ray intensity occurred near mid-orbital phase, approximately 1.5 days after X-ray turn-on. Using the 1-6 keV data obtained during the 35-day OFF state, we conclude that if the optical light curve is due to heating of the large star by a blackbody source of soft X-rays, then the source must be large, radius $> 5 \times 10^9$ cm, and cool, temperature (kT) < 90 eV. During one eclipse period (November 20.8-21.0), we find evidence for 1-6 keV X-ray emission. (auth)

10769 THE POYNTING-ROBERTSON EFFECT AND EDDINGTON LIMIT FOR ELECTRONS SCATTERING WITH HARD PHOTONS. Blumenthal, G.R. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 188: No. 1, 121-129 (15 Feb 1974).

The Klein-Nishina cross-section is used to calculate the mean force due to Compton scattering on electrons with arbitrary velocity. The Eddington-limit luminosity is then calculated as a function of photon energy and as a function of temperature for a source of hard radiation, and it is shown to increase above 100 keV. The rate at which angular momentum is lost by gas orbiting a luminous point source is also calculated, and this rate is found to decrease with increasing source hardness. Finally, some implications for compact cosmic X-ray sources are discussed. (auth)

10770 THE STRUCTURE OF THE ORION NEBULA. I. OBSERVATIONS OF THE C 85α RECOMBINATION LINE. Balick, B.; Gammon, R.H. (National Radio Astronomy Observatory, Charlottesville, Virginia); Doherty, L.H. Astrophys. J. 188: No. 1, 45-52 (15 Feb 1974).

The C 85α recombination line of carbon has been mapped in Orion A with 3' resolution. The observed C II distribution is extended and asymmetric about a peak position near the radio continuum peak. Carbon emission is observed throughout the radio nebula with extensions toward the dark bay and dust lane east and northeast of the trapezium. The narrow carbon line width ($\Delta v \simeq 4$km s^{-1}) and constant velocity ($\langle v \rangle \simeq 9$ kms^{-1}) indicate a dynamically distinct and quiescent CII emitting region compared with the HII region. A model is proposed in which the HII region is partially embedded in the near side of a large neutral gas cloud. The nebula is ionization bounded by

neutral gas in the northeast and behind; the ionized gas, driven by pressure gradients, is expanding to the southwest and toward the observer. (auth)

10771 UPPER LIMIT ON 2.5-SECOND PULSATIONS FROM HERCULES X-1. Avni, Y.; Bahcall, J.N.; Joss, P.C. (The Institute for Advanced Study, Princeton, New Jersey 08540); Lamb, D.Q.; Schreier, E.; Tananbaum, H. Astrophys. J. Lett. 188: No. 2, L35-L36 (1 Mar 1974).

No pulsed power is detected with a period of 2.5 seconds in the 1972 January Uhuru observations of Her X-1. An upper limit of 7 percent is derived for amount of 2.5-s pulsed modulation relative to the observed amount of 1.24-s pulsed modulation (corresponding to an upper limit of 5×10^{-3} for the ratio of signals in the power spectrum). (auth)

10772 SOFT X-RAY VARIABILITY OF BINARY X-RAY STARS. Buff, J.; McCray, R. (Joint Institute for Laboratory Astrophysics, University of Colorado). Astrophys. J. Lett. 188: No. 2, L37-L40 (1 Mar 1974).

If X-ray stars in binary systems are neutron stars or black holes whose luminosity results from accretion from a stellar wind, they should have soft X-ray cut-offs in the observable range ($0.25\ \mathrm{keV} \lesssim \epsilon \lesssim 5\ \mathrm{keV}$) which vary in a predictable way according to the radius and inclination of the binary orbit. (auth)

10773 A THEORY OF GALACTIC NUCLEI AND QUASI-STELLAR OBJECTS. Opher, R. (Space Science Division, Ames Research Center, NASA, Moffet Field, California). Astrophys. J. 188: No. 1, 201-205 (15 Feb 1974).

A theory is presented based on the assumption that interactions are cosmologically induced, resulting in depressed coupling constants in very compact objects (VCOs) which are identified with QSOs and galactic nuclei. The resulting model is that of a nuclear-burning shell surrounding an inert core. The shell thickness l, the single parameter of the theory, is in units of the Schwarzschild radius of the VCO and is much less than 1. The theory predicts: (1) The total mass (or energy/c^2) emitted can be greater than the gravitational mass M_g. Although the law of conservation of energy is not violated, an apparent creation of matter can be observed. (2) The luminosity $\simeq 10^{38}\ M_g$ ergs s^{-1} (M_g in units of $M_\odot$). (3) The lifetime $\simeq 10^6/l$ years. (4) The minimum period of oscillation $\simeq 10^{-10}\ M_g/l$ days. (5) Only $M_g \gg 1$ can form black holes; (6) $M_g \ll M_t$ (total mass). According to prediction (1), for example, a galactic nucleus M_g can emit a mass Δm every Δt years and have $M_g \equiv (\bar{\tau}/\Delta t)\Delta m > M_g$, where M_g is the total mass emitted during the lifetime $\bar{\tau}$ of the nucleus (mass accretion is assumed to be negligible). Observationally Seyfert nuclei show evidence of having $M_g \lesssim 3\ 10^9\ M_\odot$, $\Delta m \simeq 10^6$-$10^7\ M_\odot$, $\Delta t \simeq 10^5$-10^4 years, $\bar{\tau} > 10^9$ years, and $M_g > 10^9$-$10^{11}\ M_\odot$. In support of prediction (6) massive dead stars in a globular cluster should gravitate to the center in $\sim 10^6$-10^8 years and form a VCO; experimentally $M_g/M_t \ll 1$ is indicated for the dead stars. The above predictions are discussed and compared with existing astrophysical data. (auth)

10774 OSO-7 OBSERVATIONS OF A HIGH-LATITUDE X-RAY SOURCE ASSOCIATED WITH ABELL CLUSTER A2052. Heinz, C.J.; Clark, G.W.; Lewin, W.H.G.; Schnopper, H.W.; Sprott, G.F. (Department of Physics and Center for Space Research, Massachusetts Institute of Technology). Astrophys. J. Lett. 188: No. 2, L41-L43 (1 Mar 1974).

An X-ray source with a flux of 1.6×10^{-10} ergs $s^{-1}cm^{-2}$ (2-10 keV) has been observed at high galactic latitude by the MIT X-ray detectors on the OSO-7 satellite. Designated GX 8 + 50, its position is $\alpha = 15^h14^m2$, $\delta = 6°51'$, with a 90 percent confidence error circle of area 0.5 deg^2. The data are consistent with a power-law spectrum with $\alpha = 1.2\pm0.2$ or a thermal-bremsstrahlung spectrum with $kT = 4\pm1$ keV. A likely identification is the Abell cluster A2052, whose center coincides with the radio source 3C 317. (auth)

10775 THE DIPOLE MOMENT OF ISOCYANIC ACID, HNCO, AND ITS ASTROPHYSICAL CONSEQUENCES. Hocking, W.H.; Gerry, M.C.L. (Department of Chemistry, University of British, Columbia, Vancouver); Winnewisser, G. Astrophys. J. Lett. 187: No. 2, L89-L91 (15 Jan 1974).

The component of the dipole moment of $D^{14}N^{12}C^{16}O$ along its b-inertial axis (μ_b) has been found from measurements of the Stark effect to be 1.35 ± 0.1 debye. This value, when combined with earlier data, gives a total dipole moment of 2.1 ± 0.15 debye. It is shown that the value of μ_b for $H^{14}N^{12}C^{16}O$ lies within the quoted error limits of that for $D^{14}N^{12}C^{16}O$. Thus the microwave emission of the 4_{13}-3_{12} rotational transition of $H^{14}N^{12}C^{16}O$ in the direction of the galactic radio source Sgr B2 is emitted by rotational levels that have lifetimes for spontaneous emission of only ~120 s. If only collisional excitation is considered, the density of H_2 molecules in the core of the Sgr B2 cloud must be $\gtrsim 10^8\ cm^{-3}$. We discuss some further K-type doublet transitions of HNCO, which might be detected in space. (auth)

10776 SEARCH FOR GRAVITATIONAL RADIATION FROM PULSARS. Mast, T.S.; Nelson, J.E.; Saarloos, J.A. (Lawrence Berkeley Laboratory, University of California, Berkeley). Astrophys. J. Lett. 187: No. 2, L49-L52 (15 Jan 1974).

A search for gravitational radiation from pulsars and other periodic radiators was performed using a seismometer and the Earth as a detector. The amplified output of a vertical seismometer was sampled, recorded on magnetic tape, and Fourier transformed. Data were collected at two quiet sites in California and searched over the range of 0.1-125 Hz both for any signals of narrow bandwidth and for signals at the periods and half-periods of 81 known pulsars. No signals were found. Our upper limit on the Earth motion due to such signals varies from 10^{-11} m near 1 Hz to 10^{-14} m near 125 Hz. (auth)

10777 A SEARCH FOR ISOLATED RADIOFREQUENCY PULSES. Huguenin, G.R. (University of Massachusetts, Amherst); Moore, E.L. Astrophys. J. Lett. 187: No. 2, L57-L58 (15 Jan 1974).

We have searched for isolated radiofrequency pulses of extraterrestrial origin, relying on their dispersed arrival time to distinguish them from terrestrial interference. Simultaneous observations at widely separated stations produced no coincident events, although several isolated events showing the expected signature were seen at each station. (auth)

10778 MICROWAVE DETECTION OF INTERSTELLAR CH. Turner, B.E. (National Radio Astronomy Observatory, Charlottesville, Virginia); Zuckerman, B. Astrophys. J. Lett. 187: No. 2, L59-L62 (15 Jan 1974).

The $^2\Pi_{1/2}$, J=1/2 A-doublet transition of CH has been detected in emission in the direction of Cas A, at a frequency of 3349.185 MHz. For an assumed 10 percent population inversion the CH/H abundance ratios in the Orion and Perseus arm clouds are 3×10^{-9} and 10^{-9}, respectively, if the observed line is the F=1-1 hyperfine component. (auth)

10779 SOUTHERN RADIO SOURCES POSSIBLY IDENTIFIED WITH X-RAY SOURCES. Sanduleak, N.; Dolan, J.F. (Warner and Swasey Observatory, Case Western Reserve University). Astrophys. J. Lett. 187: No. 2, L73-L74 (15 Jan 1974).

Three radio sources in the southern Milky Way have published coordinates which nearly coincide with well-determined positions of three X-ray sources in the 3U catalog. They may represent the radio counterparts of these X-ray sources. (auth)

10780 OPTICAL IDENTIFICATION OF SOUTHERN RADIO SOURCES. II. Lasker, B. M.; Smith, M. G. (Cerro Tololo Interamerican Observatory, La Serena, Chile). Aust. J. Phys.; 27: No. 1, 135-138(Feb 1974).

From a study of the fields of 11 southern radio sources, six identifications are suggested with faint galaxies and three with compact objects, while two fields appear blank to the limits of photographs. Additional material for one previously identified field is also given. (auth)

10781 SPECTROSCOPIC SURVEY OF 92 QSO CANDIDATES. Baldwin, J. A. (Univ. of California, Santa Cruz); Burbidge, E. M.; Hazard, C.; Murdoch, H. S.; Robinson, L. B.; Wampler, E. J,. Astrophys. J.; 185: No. 3, 739-745(1 Nov 1973).

Spectra were obtained for 92 quasar candidates selected mostly on the basis of their proximity to radio-source positions. Thirty-six were classified as quasars on the basis of broad emission lives and stellar appearance, and redshifts were determined for 14. (auth)

10782 ON THE PASSAGE OF RADIATION THROUGH INHOMOGENEOUS, MOVING MEDIA. II. THE ROTATING, DIFFERENTIALLY SHEARED MEDIUM. Lerche, I. (Enrico Fermi Institute and Department of Physics, University of Chicago). Astrophys. J. 187: No. 3, 597-608 (1 Feb 1974).

Using an idealized model, we set up and discuss the transport of radiation (under the geometrical optics approximation) through a rotating medium where the rotational speed may be comparable to the speed of light. In an appendix we give the results of a calculation for wave propagation using a simple mechanical model of such a medium. The mathematical complexity introduced by rotating into even the simple mechanical model is such that we have resorted to an idealized model to illustrate the essential physical processes at play with the minimum amount of mathematical obscuration concomitant with physical understanding. The results obtained may be of interest in connection with the problem of radiation transport through pulsar magnetospheres. (auth)

10783 ON THE PASSAGE OF RADIATION THROUGH INHOMOGENEOUS, MOVING MEDIA. I. THE PLANE, DIFFERENTIALLY SHEARED MEDIUM. Lerche, I. (Enrico Fermi Institute and Department of Physics, University of Chicago). Astrophys. J. 187: No. 3, 589-596 (1 Feb 1974).

We set up the equations which describe the transport of rays and waves in differentially sheared media. For media of constant phase refractive index, we illustrate how a thin pencil of waves entering almost normal to the surface is distorted and refracted as it passes

through the slab. The results are of interest to the problem of transport of radiation through pulsar magnetospheres, which corotate near the underlying neutron star, and which differentially shear near the so-called speed-of-light circle. (auth)

10784 A SLAVED DISK MODEL FOR HERCULES X-1. Roberts, W.J. (California Institute of Technology, Pasadena). Astrophys. J. 187: No. 3, 575-584 (1 Feb 1974).

A markedly inclined rotational axis for HZ Herculis could have a dramatic effect on the observed behavior of the binary system. I present a qualitative discussion of possible connections between certain observations and a precession of the axis of HZ Her. An accreting disk is oriented by the axial direction HZ Her. The changing orientation of this disk can economically account for the periodic appearance and disappearance of the pulsar every 35.5 days. (auth)

10785 A SEARCH FOR SOFT X-RAY SOURCES IN THE GALACTIC ANTICENTER. ABSORPTION OF X-RAYS FROM THE CRAB NEBULA. Hill, R.W.; Burginyon, G.A.; Seward, F.D.; Stoering, J.P.; Toor, A. (Lawrence Livermore Laboratory, University of California, Livermore). Astrophys. J. 187: No. 3, 505-510 (1 Feb 1974).

Results are presented from the third part of a three-part survey of the galactic plane for cosmic X-ray sources in the energy range 0.2-18 keV. This part of the survey covers the region from Cassiopeia to Puppis, galactic longitudes 110°-270°. The sources detected by the experiment were Cas A, the Crab Nebula, Vel X, and Pup A. Spectral parameters were derived for the Crab using a power-law photon spectrum: $N_p = CE^{-\alpha} \exp(-\sigma\eta_h)$, where $\alpha = 2.0 \pm 0.1$ and $\eta_h = (2.0 \pm 0.3) \times 10^{21}$ hydrogen atoms cm^{-2}. Upper limits are given for the intensities of several other supernova remnants scanned during the experiment. (auth)

Solar Phenomena

10786 (N-72-14807) SOLAR WIND RADIATION DAMAGE EFFECTS IN LUNAR MATERIAL. Lunar Sample Analysis Program. Final Technical Report. Hapke, B.; Cohen, A. J.; Cassidy, W. A. (Pittsburgh Univ., Pa. (USA). Dept. of Earth and Planetary Sciences). 30 Nov 1971. Contract NAS9-9942. 71p. (NASA-CR-115309). NTIS.

The research on solar-wind radiation damage and other effects in lunar samples which was conducted to understand the optical properties of lunar materials is reported. Papers presented include: solar radiation effects in lunar samples, albedo of the Moon, radiation effects in lunar crystalline rocks, valence states of 3rd transition elements in Apollo 11 and 12 rocks, and trace ferric iron in lunar and meteoritic titanaugites. (STAR)

10787 (N-74-13522) EFFECTS OF HEAVY IONS ON ELECTRON TEMPERATURES IN THE SOLAR CORONA AND SOLAR WIND. Nakada, M. P. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). 1972. 20p. (NASA-TM-X-69899). NTIS $3.00.

The effects of the reduction in the thermal conductivity due to heavy ions on electron temperatures in the solar corona and solar wind are examined. Large enhancements of heavy ions in the corona appear to be necessary to give appreciable changes in the thermal gradient of the electrons. (auth) (STAR)

10788 OBSERVATIONS OF THE CHROMOSPHERIC NETWORK: INITIAL RESULTS FROM THE APOLLO TELESCOPE MOUNT. Reeves, E.M.; Foukal, P.V.; Huber, M.C.E.; Noyes, R.W.; Schmahl, E.J.; Timothy, J.G.; Vernazza, J.E.; Withbroe, G.L. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory, Cambridge, Massachusetts 02138). Astrophys. J. Lett. 188: No. 1, L27-L29 (15 Feb 1974).

A preliminary analysis of early data taken by the HCO spectrometer on Skylab shows that the solar chromospheric network can be clearly seen with varying contrast in the extreme-ultraviolet emission characteristic of temperatures between 10^4°K(the Lyman continuum) and 3×10^5°K (O VI). In the emission of Mg x, a coronal line formed at about 1.5×10^6°K, the network is generally unrecognizable. This is interpreted as being due to a spreading of the magnetic field lines of the network boundary in the height interval corresponding to the temperature difference between 3×10^5° and 1.5×10^6°K. We note that in certain anomalous cases, bright points of the network are seen to extend with high contrast and essentially unchanged in their cross-section through the full range of temperatures characteristic of the chromosphere, transition region, and low corona. (auth)

10789 EVIDENCE OF SOLAR-CYCLE VARIATIONS IN THE SOLAR WIND. Intriligator, D.S. (University of Southern California, Los Angeles, California 90007). Astrophys. J. Lett. 188: No. 1, L23-L26 (15 Feb 1974).

Solar-wind observations are presented from 1965 July through 1971 June that show the first evidence for long-term variations in the solar wind associated with changes in the solar cycle. The observations indicate that the frequency of high-speed streams in the solar wind and their duration vary over the solar cycle. There are more days associated with high-speed streams during solar maximum than during solar minimum. The yearly average of the solar-wind speed varies over the solar cycle and is highest at solar maximum. These measurements also provide the first direct observational evidence for changes in the solar wind which can account for the solar-cycle modulation of the cosmic-ray intensity. (auth)

10790 THE SPECTRA OF S XIII AND S XIV IN THE REGION 25-40 Å. Goldsmith, S.; Oren, L. (Department of Physics and Astronomy, Tel-Aviv University, Israel); Cohen, L. Astrophys. J. 188: No. 1, 197-200 (15 Feb 1974).

The spectra of S XIII and S XIV in the wavelength region 25-40 Å consist of transitions between levels of principal quantum numbers $n=2$ to $n=3$. Twenty new transitions were identified by the aid of various extrapolations. The methods of calculations are discussed in detail. (auth)

10791 SCATTERING OF ALFVÉN WAVES BY RANDOM DENSITY FLUCTUATIONS. Valley, G.C. (Systems Technology Department, Calspan Corporation). Astrophys. J. 188: No. 1, 181-189 (15 Feb 1974).

The scattering of coherent Alfvén waves by random density fluctuations is considered, using both the method of first-order smoothing and the first Born approximation. The method of first-order smoothing provides dispersion relations for the propagation of Alfvén waves in an infinite medium in which the density is a spatially homogeneous random function. The Born approximation is used to solve the problem of the scattering of a coherent Alfvén wave by a patch of density fluctuations and to calculate the mean square scattered dilatation (divergence of velocity) and vorticity and the ratio of average total energy scattered into magnetosonic modes to that scattered into Alfvén modes. It is shown that in general a coherent Alfvén wave undergoes damping while propagating through a medium which contains random density fluctuations, and several interesting properties of the mean scattered energy are discussed. Applications of the results to hydromagnetic wave propagation in the solar wind, scattering of Alfvén waves by tangential discontinuities, and the problem of heating the solar wind are given. (auth)

10792 THE OUTER SOLAR CORONA AS OBSERVED FROM SKYLAB: PRELIMINARY RESULTS. MacQueen, R.M.; Eddy, J.A.; Gosling, J.T.; Hildner, E.; Munro, R.H.; Newkirk, G.A. Jr.; Poland, A.I.; Ross, C.L. (High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado). Astrophys. J. Lett. 187: No. 2, L85-L88 (15 Jan 1974).

The white-light coronagraph experiment has made frequent, periodic observations of the solar corona from 1.5 $R_\odot$ to 6.0 $R_\odot$ during the Skylab mission, and these observations will permit the determination of the three-dimensional extent of coronal forms. There are several time scales on which visual changes in coronal structures occur, ranging from approximately one-half rotation to less than hours. A number of events corresponding to the shortest time scale—coronal transients—cause major restructuring of the corona. (auth)

10793 THEORIES OF THE GEOMAGNETIC AND SOLAR DYNAMOS. Gubbins, D. (Massachusetts Inst. of Tech., Cambridge). Rev. Geophys. Space Phys.; 12: No. 2, 137-154(May 1974).

A review of recent advances in dynamo theory is presented in relation to the problems of the generation of the Earth's and the Sun's magnetic fields. Some relevant modern observations and estimates of physical quantities are discussed, and the lack of knowledge about the dynamical state of the Earth's core is emphasized. The dynamo problem is conveniently separated into the kinematic approach and the dynamical problem. Attention is given to the low-conductivity limit because this allows many of the theories to be exhibited in their simplest form. Dynamical dynamo models, driven either by an applied body force or by thermal convection, are described. Emphasis is on simple examples, at least as far as Cowling's theorem permits. 156 references. (auth)

10794 SOLAR PROTON FLUENCES FOR 1977-1988 SPACE MISSIONS. King, J. H. (Goddard Space Flight Center, Greenbelt, MD). J. Spacecraft Rockets; 11: No. 6, 401-408(Jun 1974).

The probability with which any given solar proton fluence level will be exceeded during a space mission is computed for missions to be flown during the active phase of the next solar cycle (1977-1983). This probability is a function of fluence level, proton energy threshold, and mission duration. Calculations are based on 1966-1972 data only. In estimating mission fluences, a distinction is made between ordinary and anomalously large events. Probable numbers of each type of event are estimated from Burrell's extension Poisson statistics. Fluences of all anomalously large events are assumed to have a spectrum given by the August 1972

event, while fluences of the ordinary events are assumed to obey a log normal distribution. (auth)

10795 NUMBER OF SUNSPOT GROUPS FORMED BETWEEN 1962 AND 1964 AND THEIR AVERAGE LIFETIME. Kopecky, M.; Kopecka, F. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 2, 79-81(1974).

The paper complements the values of the number of formed sunspot groups and their average lifetimes, already published earlier for the period from 1874 to 1961. (auth)

10796 SPECTRAL LINES SUITABLE FOR SUNSPOT INVESTIGATIONS. Buurman, J. (Astronomical Inst., Utrecht). Astron. Astrophys., Suppl. Ser.; 15: No. 1, 35-46(Apr 1974).

Spectrograms from a large umbra (λλ5000-6900 Å) have been obtained in both directions of circular polarization simultaneously. The observational data and their reduction is described. The spectrograms from the dark core of the umbra were used to select spectral lines with and without magnetic splitting, which are suitable for sunspot investigations. Tables of lines of various splitting patterns are presented. Some important profiles are reproduced and discussed. Some peculiar V I profiles are described. A new method is discussed to adjust the spectrograms of both polarization directions to the same wavelength scale by means of umbral molecular lines. (auth)

10797 VIBRATION-ROTATION BANDS OF HF, HBr, AND HI IN THE SUNSPOT SPECTRUM. Pande, M. C.; Gaur, V. P. (Uttar Pradesh State Observatory, Naini Tal, India). Bull. Astron. Inst. Czech.; 25: No. 2, 81-82(1974).

The calculated equivalent widths of R(7), R(9), and R(13) lines of 1-2 vibration-rotation band of HF for Henoux's (1969) sunspot model suggest the presence of this band in sunspot spectrum. The reasons for the absence of the vibration-rotation bands of HBr and HI in the sunspot spectrum are discussed. (auth)

10798 BALLIK-RAMSEY BAND IN SOLAR SPECTRUM. Pande, M. C.; Sinha, K. (Uttar Pradesh State Observatory, India). Bull. Astron. Inst. Czech.; 25: No. 2, 83-84(1974).

Equivalent width calculations for a line 1.83 μ of the 0-0 vibrational band of the Ballik-Ramsey band system was carried out in two photospheric models — BCA and HSRA. Center-to-limb variation of the above line is given for BCA. Calculations show that this band may be observable in the photospheric spectrum. (auth)

10799 MODELS OF THE SOLAR CHROMOSPHERE. Paciorek, J. (Univ., Wroclaw). Postepy Astron.; 22: No. 1, 33-43 (1974). (In Polish).

Three empirical models of the chromosphere are confronted and discussed. The accuracy of their agreement with observational data is considered. Some attempts at the interpretation of the latest observations of the line and continuous spectra in the frame of non-homogeneous models are also discussed. (auth)

10800 REGULARITY IN CHANGES OF THE LENGTH OF THE SOLAR SPOT CYCLES. Szymanski, W. Postepy Astron.; 22: No. 1, 45-47(1974). (In Polish).

It seems that the changes in the length of the solar spot cycles constantly decrease. (auth)

10801 INFLUENCE OF A TRAVELING ACOUSTIC WAVE ON SPECTRAL LINE PROFILES. I. Oscillations in the Central Intensity of Fraunhofer Lines. Kostyk, R. I. (Glavnaia Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 18, 94-99(1973). (In Russian).

10802 FORMATION OF C_2 MOLECULES IN SOLAR ATMOSPHERE. Sinha, K.; Pande, M. C. (Uttar Pradesh State Observatory, India). Bull. Astron. Inst. Czech.; 25: No. 2, 84-86(1974).

It is shown that while the triplet states of Swan bands are populated through an LTE path, the singlet states of Phillips bands are not. The problems regarding the observations of the various bands of C_2 molecules in the solar photospheric and umbral spectra are discussed in the light of this result. (auth)

10803 SOLAR CORONA. Rozelot, J. P. Paris; Hautes-Pyrenees (1973). 134p. (In French). $7.85.

The monograph offers a review of knowledge about the solar corona in terms of its brief history, recent development, and present status. Following a brief description of the sun and its atmosphere, the nature, structure, and observation methods of the solar corona are discussed, along with the interpretation of coronal spectra and the distribution, polarization, and identification of coronal lines. Special attention is given to uv, euv, and x radiation studies of the corona and to investigations of coronal radio-frequency emissions. Coronal connections with the ambient interplanetary medium and the implications of coronal activity are also examined. (IAA)

10804 FINE STRUCTURE OF THE RADIOSPECTRA OF EARLY PHASE OF PLASMA INSTABILITY DURING THE SOLAR FLARE AUGUST 4, 1972. Krivsky, L.; Tlamicha, A. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 2, 126-127(1974).

In the early phase of the solar cosmic flare of August 4, 1972 a fine and quasi-perpendicular short-living pulsation structure was observed on the periphery of the Type IV bursts of the solar radio spectra. These fine structures might be interpreted as the propagation of magnetohydrodynamic signals (or electrons) with very high velocities. (auth)

10805 STUDIES OF MODULATION AND SOLAR PARTICLE EVENTS USING NEUTRON MONITOR MULTIPLICITIES. Kent, D.W. (Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania 19081). J. Geophys. Res. 79: No. 1, 271-274 (1 Jan 1974).

A comparison of the response of multiple events in a neutron monitor with that of the total counting rate can be used as a means of studying spatial variations of the energy spectrum of modulation in Forbush decreases as well as a means of studying solar particle events. Events with multiplicity of 4 or greater are compared with the total counting rates at the Bartol network of stations during seven Forbush decreases and three solar particle events that occurred in the period 1970-1973. Spectral indices are then estimated on the basis of a modified form of calculated yield functions. (auth)

10806 SUNSPOT MODELS WITH ALFVÉN WAVE EMISSION. Mullan, D.J. (Bartol Research Foundation of The Franklin Institute, Swarthmore, Pennsylvania 19081). Astrophys. J. 187: No. 3, 621-632 (1 Feb 1974).

Sunspot models have been computed on the assumption that the missing flux is transported by undissipated Alfvén waves. In order to estimate the flux of these waves, we propose an extension of Öpik's cellular model of convection to include the effects of a vertical magnetic field on horizontal gas flow. Horizontal motions, not vertical motions, are impeded more or less severly depending on the electrical conductivity, and this reduces the convective flux. These motions, however, shake the field lines; and this is assumed to be a source of Alfvén waves, compensating for the reduction in the convective flux. The free parameter D/H (ratio of cell diameter to cell depth) is adjusted such that the total sum of radiative convective, and Alfvén wave fluxes remains constant at all depths and equals the undisturbed solar flux entering the spot from below. Our treatment is speculative to some extent, but it leads to a unique spot model for a given field strength. We derive the depth-dependence of the effective temperature T_e in a spot, and find that it increases nonmonotonically from a low value at the surface (2750°K in a spot with magnetic field B=3000 gauss) to the solar value (5780°K) at depth z. The latter turns out to lie within 1 percent of the depth of the solar convection zone in all cases of interest. Convection cells in sunspots are found to be narrow cylinders ($D/H \lesssim 0.2$ and decreasing, the stronger the field) aligned along the field lines. The diameter of a cell at the top of a spot with B=3000 gauss is about 80 km. The depth z_* where the Alfvén wave flux has a maximum is found to be 841 km in a spot with B=3000 gauss, and z_* decreases with decreasing B. The values of z_* seem to correspond with the "Wilson depression." Radiative influx of heat from the walls of a spot is found to be minimal for B=2000-3000 gauss, and increases rapidly outside this range. Thus spots with B in this range are expected to live longest, and the most common observed field strengths are expected to lie in this range. If radiative heating is responsible for the lower limit on the permissible field strength in spots (1200 gauss), then there should also be an upper limit on spot field strength at 5300 gauss. (auth)

10807 OBSERVATIONS OF He I 584 Å NIGHTTIME RADIATION; EVIDENCE FOR AN INTERSTELLAR SOURCE OF NEUTRAL HELIUM. Paresce, F.; Bowyer, S.; Kumar, S. (Department of Astronomy and Space Sciences Laboratory, University of California, Berkeley). Astrophys. J. 187: No. 3, 633-640 (1 Feb 1974).

The intensity and spatial variations of the He I 584 Å radiation in the night sky were measured to an altitude of 264 km from a sounding rocket launched from Thumba, India. The flux varied in intensity with look angle from a high of 16±5 rayleighs to a low of <1 rayleigh. The data obtained are presented in the form of an all-sky map. Since the peak flux levels observed are approximately two orders of magnitude larger than that expected from geocoronal resonant scattering, we have compared our results with those expected from two interplanetary sources of neutral helium: the penetration of the local interstellar medium into the solar neighborhood and the dust deionization of solar-wind alpha particles. The dust de-ionization-model predictions using currently accepted input parameters appear to be inconsistent with the observations. The interstellar helium source is compatible with the data to within the uncertainties of the models. (auth)

10808 A COMPARISON OF THE GEOMAGNETIC AP INDEX WITH FLUCTUATIONS IN B AND V: MARINER 5. Jones, D.E.; Ballif, J.R.; Melville, J.G. (Department of Physics and Astronomy, Brigham Young University, Provo, Utah 84601). J. Geophys. Res. 79: No. 1, 286-288 (1 Jan 1974).

The solar wind plasma and magnetic field data from Mariner 5 offer an opportunity to conduct at least a partial test of two models, which incorporate variability of interplanetary parameters. (AIP)

10809 OBSERVATIONS OF ELECTRONS AT THE LUNAR SURFACE. Goldstein, B.E. (Jet Propulsion Laboratory, Pasadena, California 91103). J. Geophys. Res. 79: No. 1, 23-35 (1 Jan 1974).

Observations of electrons at the Apollo 12 and 15 sites by the Alsep Solar Wind Spectrometer experiments showed qualitative differences. In the geomagnetic tail the Apollo 15 instrument provided measurements of lunar photoelectron flux from 5 to 40 eV; at 20 eV the flux was 2×10^6 el/cm^2 sec eV ster. The estimated height–integrated conductivity of the photoelectron layer is 10^{-4} to 10^{-5} ohm^{-1}. A theoretical model, ignoring the magnetic field, indicates that most solar wind electrons should reach the lunar suface; a lunar surface potential at the subsolar point of +5 to –3 V is calculated. At the Apollo 15 site (6–γ local magnetic field) electron densities and temperatures agree with this model. At the Apollo 12 site (38–γ local field) energetic nonsymmetric electron fluxes are observed. The data support a local space charge separation and a magnetic field of 5 km scale size or less. Downward–moving solar wind electrons require a balancing current due to upward-moving lunar photo-electrons; this suggests that the less energetic lunar photoelectrons should decrease electron pressure on magnetic field lines connected to the moon. When the magnetic field and solar wind velocity are approximately parallel, a solar wind density enhancement upstream of the moon is required for pressure balance. (auth)

10810 EFFECTS OF HEAVY IONS ON ELECTRON TEMPERATURES IN THE SOLAR CORONA AND SOLAR WIND. Nakada, M.P. (NASA Goddard Space Flight Center, Greenbelt, Maryland 20771). J. Geophys. Res. 79: No. 1, 36-39 (1 Jan 1974).

The effects of the reduction in the thermal conductivity due to heavy ions on electron temperatures in the solar corona and solar wind are examined. Large enhancements of heavy ions in the corona appear to be necessary to give appreciable changes in the thermal gradient of the electrons. These enhancements, if they should occur, may contribute to the understanding of some low values of solar wind temperature measurements at 1 AU. (auth)

10811 MOTIONS OF THE BOW SHOCK INDUCED BY INTERPLANETARY DISTURBANCES. Völk, H.J.; Auer, R. (Max–Planck–Institut für Physik und Astrophysik, Institut für extraterrestrische Physik Garching bei München, Germany). J. Geophys. Res. 79: No. 1, 40-48 (1 Jan 1974).

Motivation by recent observations by Greenstadt and co–workers of very high bow shock 'normal' velocities, we investigate the reaction of the shock to changes in solar wind conditions for different bow shock locations. At low quiescent Mach numbers the shock is found to be much more sensitive to a given slow perturbation than it is at the normally occuring high Mach numbers. Thus under these circumstances even a smooth wavelike disturbance can cause high bow shock velocities. For high Mach numbers only impulsive perturbations like tangential discontinuities or occasional interplanetary shocks can induce high bow shock velocities. The former interaction is discussed in detail. Large induced shock velocities are possible, although very strong density discontinuities are needed to produce recently estimated average shock speeds of about 85 km/sec. Thus such high average shock velocities are difficult to understand. In this context also a qualitative discussion of the importance of oscillatory modes of the magnetosphere shock system is presented. The present work suggests average bow shock velocities of the order of 10 km/sec or somewhat larger. Much higher shock speeds should be the exception rather than the rule. (auth)

10812 VARIABILITY OF INTENSITY RATIOS OF H TO He AND He TO $Z\geq3$ IONS IN SOLAR ENERGETIC PARTICLE EVENTS. Van Allen, J.A. (Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa 52242); Venkatarangan, P.; Venkatesan, D. J. Geophys. Res. 79: No. 1, 1-8 (1 Jan 1974).

By means of data from the University of Iowa solid state detector on Explorer 35, a study has been made of the intensity ratios of H to He and He to ions with atomic numbers $Z\geq3$ in the sub–MeV per nucleon specific kinetic energy range for the following solar energetic particle events: June 9, 1968; November 18, 1968; April 11, 1969; May 13, 1969; and, by reference to a previous paper, the events of February 25 and March 30, 1969. The principal finding is that the intensity ratios H/He and He/($Z\geq3$) in the sub–MeV per nucleon specific kinetic energy range vary markedly from event to event and more especially during the time history of individual events. Hence these ratios have no simple relationship to 'solar abundances' in the usual sense of that term. The general pattern of the time variability of He/($Z\geq3$) during an event is that it starts with a low value (i.e., relatively rich in $Z\geq3$ ions) and increases more or less monotonically and sometimes dramatically as the event proceeds. Despite instrumental characteristics that permit certain ambiguities of interpretation, it is reasonably certain that He/($Z\geq3$) varies by as much as an order of magnitude. The H/He ratio usually exhibits a qualitatively similar time history, there being marked relative enhancement of He early in events. Our principal interpretative suggestion is that differential diffusion of the various ionic species with differing magnetic rigidities is the dominant physical cause of observed variabilities. The evidence favors the hypothesis that $Z\geq3$ ions in the sub–MeV per nucleon energy range is less than completely ionized. (auth)

10813 THE SOLAR PROTON DIFFUSION MEAN FREE PATH AND THE ANISOTROPIC PARTICLE EVENT OF NOVEMBER 18, 1968. Quenby, J.J. (Physics Department, Imperial College, London S. W. 7, England); Morfill, G.E.; Durney, A.C. J. Geophys. Res. 79: No. 1, 9-16 (1 Jan 1974).

Neutron monitor impact zones for the November 18, 1968, flare event are examined. The peak interplanetary intensity, deduced by using the asymptotic acceptance cones, agrees well with the interplanetary field direction; this result has been found by previous investigations. The diffusion coefficients for 0.043– and 3–GV particles found by considering the backscatter time during the very anisotropic propagation phase are 5 and 12 times larger, respectively, than those estimated from the observed local spectrum of interplanetary field fluctuations by using the simple quasi–linear diffusion theory. The lack of scattering during the flare that occurred within the recovery of a Forbush decrease favors a barrier mechanism as being the sole cause of the latter event. Absence of solar protons coming down the geomagnetic tail, unlike observations at lower rigidities during this event, can be explained in terms of conventional ideas on the tail width. (auth)

10814 PERTURBATION OF THE SOLAR WIND BY THE LUNAR ATMOSPHERE. Wallis, M.K. (Mathematical Institute, Oxford University, England). J. Geophys. Res. 79: No. 1, 275-279 (1 Jan 1974).

The effects of atmospheric ions on the solar wind flow past the moon may be represented by source terms in a steady flow. The sources appropriate to ions of large Larmor radius are found to differ qualitatively from those given earlier (Siscoe and Mukherjee, 1972). The transverse force is the major perturbing effect and gives limits on the lunar atmospheric density at some 5 times higher than those previously derived. (auth)

10815 FURTHER REMARKS ON PLASMA INSTABILITIES PRODUCED BY IONS BORN IN THE SOLAR WIND. Wu, C.S. (Institute for Fluid Dynamics and Applied Mathematics, University of Maryland, College Park, Maryland 20742); Hartle, R.E. J. Geophys. Res. 79: No. 1, 283-285 (1 Jan 1974).

Plasma instabilities in the solar wind are produced by newly born ions of planetary and interstellar origin. The resulting collective excitation processes may rapidly consume the free energy of the newly born ions, and consequently these ions eventually become assimilated into the solar wind.(AIP)

10816 RELATIONSHIP BETWEEN INTERPLANETARY PLASMA PARAMETERS AND GEOMAGNETIC DST. Kane, R.P. (Physical Research Laboratory, Ahmedabad 380009, India). J. Geophys. Res. 79: No. 1, 64-72 (1 Jan 1974).

The relationship berween interplanetary plasma parameters and geomagnetic Dst is studied for individual storms and also on a statistical basis using hourly and 3–hourly values. It is shown that a turning of B, from northward to southward acts only as a trigger for letting solar wind into the magnetosphere. Whereas this produces quick changes in the polar region, the mid–latitude Dst develops a few hours later, generally if the solar wind density N is high. Solar wind velocity seems to play a comparatively minor role. (auth)

Galaxies

Refer also to abstracts 10726, 10743, 10767, 10773, and 10774.

10817 (CONF-730804-P1, pp 402-406) GENERATION OF LARGE-SCALE MAGNETIC FIELDS BY TURBULENT VELOCITY FIELDS. Lerche, I. (Univ. of Chicago). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

Using Kraichnan's direct interaction approximation the nonlinear singular integral equations were set up and solved which describe (in a statistically exact manner) the kinematic generation of a large scale magnetic field by incompressible velocity turbulence. The properties of the resulting large-scale magnetic field depend sensitively on the nature of the velocity turbulence. It was found that: (i) if the turbulence is static then the large-scale field is degenerative no matter whether the velocity turbulence is isotropic or cyclonic (i.e., possessing a net helicity); (ii) if the turbulence

occurs under Parker's "short-sudden" approximation then the large-scale magnetic field is degenerative unless the velocity turbulence possesses a net helicity when regeneration occurs. (iii) if the velocity turbulence is possessed of a net helicity, no matter how small, then the Fourier transform of the average Green's stress tensor enjoys equipartition of its symmetric and anti-symmetric parts at the normal modes of the large-scale field; if, however, the helicity is zero, the Green's stress tensor is symmetric and no equipartition statement is available. These statistically exact calculations point the way to a general method of investigating the generation and maintenance of the Galactic large-scale magnetic field by differential rotation and the turbulent velocity field in the Galaxy. (auth)

10818 (CONF-730804-P1, pp 408-413) POSSIBLE EXPLANATION FOR THE ORIGIN OF THE GALACTIC MAGNETIC FIELD AND ITS CORRELATION TO THE COSMIC-RAY PHENOMENA. Bagge, E. R. (Univ., Kiel). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

A theory for the movement of the interstellar gas under the influence of the gravitational field in the neighborhood of the galactic arms is developed. If this gas bears electric charges of one sign ($\rho_e \sim 200$ to 2000 electrons/gramm) a system of electric currents is produced by the relative velocity of the galactic gas and the spiral arms for which the streamlines are concentrated a little more to the galactic plane than above and below it. In this way a large spaced magnetic field along the galactic arms is generated with opposite directions of the magnetic field vectors on the two sides of the galactic plane. (auth)

10819 (CONF-730804-P1, pp 414-419) NONTHERMAL RADIO EMISSION FROM THE GALACTIC DISC. Cowsik, R.; Mitteldorf, J. (Univ. of California, Berkeley). 1973.

From 13th international cosmic ray conference; Denver, Colorado, USA (17 Aug 1973).

In 13th international cosmic ray conference. Vol. 1.

The intensity of synchrotron radiation from the galactic disc depends both on the magnetic field strength and on the density of the cosmic-ray electrons. Evidence based on Faraday rotation of pulsar signals indicates that the average galactic magnetic field B_0 is ~3 μGauss with fluctuations ΔB of the same order of magnitude. In this field cosmic-ray electrons with the same density as that observed near the solar system produce insufficient synchrotron radiation to account for the galactic radio background. Indeed, one needs either average fields of ~13 μGauss or about 10 times the cosmic-ray fluxes to generate the observed radio intensities. Such high magnetic fields or cosmic-ray densities can be excluded by several arguments including one given by Parker involving the force balance between their pressure gradient and the gravitational forces on the ambient interstellar gas. If, however, the magnetic field fluctuations arise because of compressions of the average fields by motions of the interstellar gas, then betatron processes induce correlated increase of the relativistic electrons in these high field regions. The average synchrotron emissivity non-linearly increases to make the estimated emissivities compatible with radioastronomical data. (auth)

10820 INFRARED SPECTRUM OF NGC 1068. Jameson, R.F.; Longmore, A.J.; McLinn, J.A.; Woolf, N.J. (University of Minnesota). Astrophys. J. Lett. 187: No. 3, L109-L110 (1 Feb 1974).

We have observed the long-wavelength (~18 μ) turnover in the spectrum of the Seyfert galaxy NGC 1068. (auth)

10821 THE MOTIONS IN THE CENTRAL REGION OF NGC 4736: EVIDENCE FOR AN EXPANDING RING. van der Kruit, P.C. (Hale Observatories, Carnegie Institution of Washington, California, Institute of Technology). Astrophys. J. 188: No. 1,3-17 (15 Feb 1974).

Extensive spectroscopic observations of the central part of NGC 4736 are presented. The analysis shows that there are noncircular motions and that a Lindblad resonance dispersion ring as the interpretation must be rejected on geometrical grounds. The most likely model is one in which the bright central ring of H II regions is expanding with a velocity of about 30 km s^{-1}, but z-motions cannot be ruled out. Discrepant velocities are established in the direction of the triple radio source. It is proposed that the central part of the disk is disturbed by nuclear activity and the accompanying expulsion of gas clouds. Although no detailed model could be constructed, it is argued that further observational data on NGC 4736 and comparison with a few other galaxies do not contradict such a model. (auth)

10822 THE STRUCTURE OF THE FORNAX DWARF GALAXY. Hodge, P.W.; Smith, D.W. (Astronomy Department, University of Washington, Seattle). Astrophys. J. 188: No. 1, 19-25 (15 Feb 1974).

New photoelectric surface photometry and new star counts are combined with previously published data to reexamine the structure of the Fornax dwarf galaxy. The new star counts show excellent agreement with King's dynamical models and with de Vaucouleurs and Ables's star counts. The new photoelectric photometry, which covers only the central regions, fits the de Vaucouleurs and Abels photometry at $\alpha \simeq 5'$, but they disagree at the center. Their outer photometry shows a different slope from that of the star counts. (auth)

10823 TENTATIVE IDENTIFICATION OF MAIN-SEQUENCE STARS IN THE NUCLEAR BULGE OF THE GALAXY. van den Bergh, S. (David Dunlap Observatory, University of Toronto, Richmond Hill, Ontario Canada). Astrophys. J. Lett. 188: No. 1, L9-L10 (15 Feb 1974).

The main-sequence population in the nuclear bulge of the Galaxy has been tentatively identified at $V > 19.5 \pm 0.3$ in a field at $l = 0°$, $b = -8°$. From these observations it is concluded that the maximum contribution to the star counts in this direction is provided by stars at a true distance modulus $(m-M)_0 = 14.8 \pm 0.5 (9.0[+2.1, -1.8]$kpc). The distance from the Sun to the galactic center, which depends on the adopted galactic density model, is slightly greater than this value. (auth)

10824 A SEARCH FOR OD IN THE GALACTIC CENTER. Allen, M. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology); Cesarsky, D.A.; Crutcher, R.M. Astrophys. J. 188: No. 1, 33-34 (15 Feb 1974).

We have unsuccessfully searched for the $\Delta F = 0\Lambda$-doublet transitions of the $^2\Pi_{3/2}$, J = 3/2 state of OD. The resulting upper limit OD/OH column density ratio is 1/400. (auth)

10825 ION-MOLECULE REACTIONS, MOLECULE FORMATION, AND HYDROGEN-ISOTOPE EXCHANGE IN DENSE INTERSTELLAR CLOUDS. Watson, W.D. (Departments of Astronomy and Physics, University of Illinois, Urbana, Illinois 61801). Astrophys. J. 188: No. 1, 35-42 (15 Feb 1974).

The influence of (positive) ion-molecule reactions on the formation and dissociation of molecules in dense (particle density $\gtrsim 10^4$ cm^{-3}) interstellar clouds is investigated. Unlike reactions between neutral molecules, no activation energy barrier inhibits these ion-molecule reactions at low interstellar gas temperatures. Based on an ionization rate due only to the observed high-energy cosmic rays, certain chemical processes are shown to occur on a time scale comparable with or faster than other relevant time scales. These processes result in the following: (a) An appreciable abundance of atoms (especially H^+,H, C^+, and O) will be maintained in the gas. (b) The abundance of complex (positive) molecular ions will be about 0.1 to 1 percent of the abundance of complex molecules (NH_3, HCN, H_2CO, etc.). (c) Because of the large abundance of H_2 and CO, essentially every ionization leads to the formation of HCO^+ which occupies a cornerstone position in the ion-molecule chemistry. Its predicted abundance is consistent for its identification with the unidentified X-ogen line. Ion-molecule reactions may, however, produce comparable abundances of other candidate molecules (C_2H, HNC). (d) Exchange of hydrogen and deuterium in ion-molecule reactions provides a mechanism in some molecules for strong chemical fractionation in favor of deuterium. In the formation of DCN, the reaction of $H_2CN^+ + HD \leftrightarrow HDCN^+ + H_2$ is expected to be in thermodynamic equilibrium and is the chief factor in determining the abundance of DCN. Based on the observation (DCN/HCN) ratio, our best estimate for the cosmic abundance of deuterium is $D/H \lesssim 10^{-4}$, independent of the exact rate of ionization. Uncertainties in this D/H are large. (auth)

10826 MOLECULAR CLOUDS IN THE GALACTIC NUCLEUS. Scoville, N.Z.; Solomon, P.M. (University of Minnesota); Jefferts, K.B. Astrophys. J. Lett. 187: No. 2, L63-L66 (15 Jan 1974).

Observations of the 2.6-mm CO line have been obtained along the galactic equator covering longitudes $|l| \leq 3°$ and velocities $|V| \leq 300$ km s^{-1}. The strongest emission is concentrated toward the center ($|l| < 1°.5$) and at low velocities (< 125 km s^{-1}). The similarities in distribution and brightness temperature between the CO and 100-μ emissions suggest that the grains and the gas are colocated and nearly in thermal equilibrium. Kinematic models for the gas in the nucleus are briefly discussed. The mass of this gas (mostly H_2) is estimated as 10^7-$10^8 M_\odot$ within 600 pc of the center. This large mass of interstellar molecules indicates that the galactic nucleus may not be deficient in Population I material. (auth)

10827 OH OBSERVATIONS OF SIXTEEN INTERSTELLAR DUST CLOUDS. Knapp, G. R.; Kerr, F. J. (Univ. of Maryland, College Park). Astron. J.; 78: No. 6, 453-457(Aug 1973).

Observations in the 1665 and 1667-MHz lines of OH of 16 interstellar dust clouds of varying densities yielded OH emission from seven of the clouds. In one cloud, the 1667-MHz line is enhanced relative to the 1665-MHz line; in another, the OH optical depth is very large or the 1665-MHz line is enhanced. The observations show that the clouds have velocities in the range −3.5 to +9.4 km/sec, velocity widths in the range 0.7−2.2 km/sec, and column densities ranging from 9×10^{13}–3×10^{15} molecules per cm^2. (auth)

10828 DARK NEBULAE, GLOBULES, AND PROTOSTARS. Lynds, B. T. (ed.). Tucson, AZ; University of Arizona Press (1971). 158p. $7.50.

Papers are presented on star counts and galactic structure, dark absorbing cloud in Carina, accurate color excess, globules, polarimetry, 21-cm studies of the association of gas and dust in the Galaxy, interstellar molecules, composition of interstellar dust, interstellar extinction curve, stars and dark nebulae, galactic infrared sources, and models of interstellar clouds. (WDM)

10829 DIRECTIONAL DEPENDENCE OF THE REDSHIFT OF GALAXIES. Bahyl, V. (Astronomical Inst., Skalnate Pleso, Czech.). Bull. Astron. Inst. Czech.; 25: No. 2, 115-120(1974).

The dependence of Hubble's constant on direction and distance was statistically studied. Different values of Hubble's constant were obtained for different directions, however, their scatter does not exceed the limits of accuracy of determining the constant itself. A slight decrease in the value of Hubble's constant with distance is shown, which might be explained under the assumption of the intergalactic absorption of the value $\Delta m = 0.003m$/Mpc. The accuracy of determining the distance modulus by means of the van den Bergh's method of luminosity classes and by means of the method of H II region sizes is discussed. (auth)

10830 METHOD OF FORMING COMPLEX MOLECULES IN INTERSTELLAR SPACE. Floyd, G. R.; Prince, R. H.; Duley, W. W. (York Univ., Toronto). J. Roy. Astron. Soc. Can.; 67: 299-305(Dec 1973).

In view of the possible presence of acetylene in the interstellar medium, experiments are reported concerning radiation-induced reactions in solid acetylene which simulate processes occurring in condensed gas mantles on grains in dense clouds. Electron irradiation is used in conjunction with a sensitive mass spectrometer and deuterium substitution to confirm product species identification. These are primarily resonance-stabilized and aromatic polymers of acetylene, and in particular C_6H_6 is a dominant reaction product. The photochemistry of C_2H_2 indicates similar species would be generated by the absorption of low-energy cosmic rays or short wavelength photons. The implications of the results for medium and high density interstellar clouds and current theories of grain processes are discussed. (auth)

10831 THE PERSEUS CLUSTER: GALAXY DISTRIBUTION, ANISOTROPY, AND THE MASS/LUMINOSITY RATIO. Bahcall, N.A. (Princeton University Observatory, Princeton, New Jersey). Astrophys. J. 187: No. 3, 439-444 (1 Feb 1974).

Counts of galaxies in the Perseus cluster are used to determine the center, the distribution of galaxies to different limiting magnitudes, the core radius, and the apparent anisotropy. The mass and luminosity of the cluster core are calculated, and the ratio of central mass to visual light is found to be about $700(H_0/100)$ solar units with conventional assumptions. (auth)

10832 ON THE NUCLEAR MOTIONS IN NGC 4151. Anderson, K.S. (Kitt Peak National Observatory). Astrophys. J. 187: No. 3, 445-448 (1 Feb 1974).

The emission lines arising from the nuclear regions of NGC 4151 indicate nuclear gas motions. It is suggested that these motions are rotational rather than radial in nature and that the emitting gas is essentially confined to the galactic plane. A rough estimate is made of the nuclear mass. (auth)

10833 FORMATION OF GALAXIES AND CLUSTERS OF GALAXIES BY SELF-SIMILAR GRAVITATIONAL CONDENSATION. Press, W.H.; Schechter, P. (California Institute of Technology). Astrophys. J. 187: No. 3, 425-438 (1 Feb 1974).

We consider an expanding Friedmann cosmology containing a "gas" of self-gravitating masses. The masses condense into aggregates which (when sufficiently bound) we identify as single particles of a larger mass. We propose that after this process has proceeded through several scales, the mass spectrum of condensations becomes "self-similar" and independent of the spectrum initially assumed. Some details of the self-similar distribution, and its evolution in time, can be calculated with the linear perturbation theory. Unlike other authors, we make no ad hoc assumptions about the spectrum of long-wavelength initial perturbations: the nonlinear N-body interactions of the mass points randomize their positions and generate a perturbation to all larger scales; this should fix the self-similar distribution almost uniquely. The results of numerical experiments on 1000 bodies are presented; these appear to show new nonlinear effects: condensations can "bootstrap" their way up in size faster than the linear theory predicts. Our self-similar model predicts relations between the masses and radii of galaxies and clusters of galaxies, as well as their mass spectra. We compare the predictions with available data, and find some rather striking agreements. If the model is to explain galaxies, then isothermal "seed" masses of $\sim 3\times 10^7$ $M_\odot$ must have existed at recombination. To explain clusters of galaxies, the only necessary seeds are the galaxies themselves. The size of clusters determines, in principle, the deceleration parameter q_0; presently available data give only very broad limits, unfortunately. (auth)

Cosmology

Refer also to abstracts 10627, 10829, 10833, 11784, 11789, and 11795.

10834 MULTIPLE INVERSE COMPTON SCATTERING AND THE DIFFUSE X-RAY COMPONENT. Bui-Van, A.; Hurley, K. (Centre d'Etude Spatiale des Rayonnements, Université Paul Sabatier, B. P. 4057, Toulouse, France). Astrophys. J. Lett. 188: No. 2, L51-L53 (1 Mar 1974).

It is shown that, when multiple scattering is taken into account, the spectrum of inverse Compton produced X-radiation is different from the single-scatter spectrum. In particular, the γ-ray fluxes in the 1-10 MeV region can increase by a factor of about 3 over the single-scatter spectrum. The significance of this result with respect to the diffuse cosmic X-ray flux is discussed. (auth)

10835 MAGNITUDE-REDSHIFT AND COUNT-MAGNITUDE RELATIONS IN PRESENCE OF AN UNIFORM INTERGALACTIC ABSORPTION. Romano, G. (Univ., Padua). Soc. Astron. Ital., Mem.; 44: 47-51(1973).

10836 FINITE EXPANDING UNIVERSE WITH INJECTION OF BOTH MATTER AND RADIATION. Kowalski, M. (Univ., Warsaw). Lett. Nuovo Cim.; 10: No. 5, 214-216(1 Jun 1974).

Gomide (1972) investigated a homogeneous, isotropic, expanding cosmological model with positive curvature and a modified version of Hoyle's vector field. He applied Mach's principle in Whitrow's formulation and found that a negative value of the cosmological constant follows. The possibility is pointed out of generalizing Gomide's result to the situation when corpuscular matter with radiation, or even radiation alone, is created. (WDM)

10837 THE EFFECT OF GRAVITATIONAL RADIATION-REACTION ON THE EVOLUTION OF THE RIEMANN S-TYPE ELLIPSOIDS. Miller, B.D. (Department of Astronomy and Astrophysics, University of Chicago). Astrophys. J. 187: No. 3, 609-620 (1 Feb 1974).

It is shown that the 2(1/2) -post-Newtonian formalism for describing gravitational radiation-reaction is equivalent to the formalism developed by Burke and Thorne, if one is neglecting lower-order post-Newtonian corrections. Since the radiation-reaction terms are then expressible as a gradient, the circulation of a fluid is not altered by the emission of gravitational radiation; from this conservation law it may be seen that a Jacobi ellipsoid, as it evolves by gravitational radiation, cannot remain on the Jacobi sequence. The equations of motion governing the evolution by radiation-reaction of the Jacobi ellipsoid and other Riemann S-type ellipsoids are integrated for several initial configurations. Evolution proceeds toward a nonradiating state which in some cases is a Maclaurin spheroid and in other cases a Dedekind ellipsoid. (auth)

Planetary Phenomena

Refer also to abstracts 9658, 10809, and 11774.

10838 (N-74-12481) ABSORPTION OF TRAPPED PARTICLES BY JUPITER'S MOONS. Hess, W. N.; Birmingham, T. J.; Mead, G. D. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Nov 1973. 20p. NTIS $3.00.

Absorption effects of the four innermost moons in the radial transport equations for electrons and protons in Jupiter's magnetosphere are presented. The phase space density n at 2 R_J for electrons with equatorial pitch angles less than 69° is reduced by a factor of 4.2×10^3 when lunar absorption is included in the calculation. For protons with equatorial pitch angles less than 69°, the corresponding reduction factor is 3.2×10^5. The effect of the satellites becomes progressively weaker for both electrons and protons as equatorial pitch angles of pi/2 are approached, because the likelihood of impacting a satellite becomes progressively smaller. The large density decreases found at the orbits of Io, Europa, and Ganymede result in corresponding particle flux decreases that should be observed by spacecraft making particle measurements in Jupiter's magnetosphere. The characteristic signature of satellite absorption should be a downward pointing cusp in the flux versus radius curve at the L-value corresponding to each satellite. (auth) (STAR)

10839 JUPITER'S BOW SHOCK STRUCTURE. Formisano, V. (Consiglio Nazionale delle Ricerche, Rome). Lett. Nuovo Cim.; 10: No. 5, 182-184(1 Jun 1974).

The position and structure of Jupiter's bow shock as predicted before Pioneer X are briefly discussed. (WDM)

10840 INTERNAL CONSTITUTION AND THE FIGURES OF THE GIANT PLANETS. Zharkov, V. N.; Trubitsyn, V. P. (AN SSSR, Moscow. Inst. Fiziki Zemli). Phys. Earth Planet. Inter.; 8: No. 1, 105-107(Feb 1974).

The equations of state of the matter contained in the giant planets are investigated. The thermal state of Jupiter, Saturn, Uranus and Neptune is considered, and the results of the calculations of their figures, gravitational potentials and models of the internal structures are given. These results were reported on the Geophysical Congress, held in Moscow, 1971. (auth)

10841 THE ELECTRON DIFFUSION COEFFICIENT IN JUPITER'S MAGNETOSPHERE. Birmingham, T. (Laboratory for Space Physics, Goddard Space Flight Center, Greenbelt, Maryland 20771). Hess, W.; Northrop, T.; Baxter, R.; Lojko, M. J. Geophys. Res. 79: No. 1, 87-97 (1 Jan 1974).

A steady state model of Jupiter's electron radiation belt is developed. The model includes injection from the solar wind, radial diffusion, energy degradation by synchrotron radiation, and absorption at Jupiter's surface. A diffusion coefficient of the form $D_{RR}/R_J^2 = kR^m$ is assumed, and then observed data on synchrotron radiation are used to fit the model. The free parameters determined from this fit are $m = 1.95 \pm 0.5$, $k = 1.7 \pm 0.5 \times 10^9$/s, and μ_1 (the magnetic moment of injected particles) $= 770 \pm 300$ MeV/G. The value of m shows quite clearly that the diffusion is not caused by magnetic pumping by a variable solar wind or by a fluctuating convection electric field. The process might be field line exchange driven by atmospheric-ionospheric winds; our diffusion coefficient has roughly the same radial dependence but is considerably smaller in magnitude than the upper bound diffusion coefficients recently suggested for this process by Brice and McDonough (1973) and S. A. Jacques and L. Davis, Jr. (unpublished manuscript, 1972) (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

10842 (INIS-mf-887-1, pp 153-162) ESTIMATION OF NATURAL ACTIVITY OF CERTAIN ISOTOPES NEAR THE EARTH'S SURFACE. Chrapan, J.; Oravec, J.; Sitar, B. (Komenskeho Univerzita, Bratislava, Czech). [nd]. (In Russian).

Data are listed on the origin of natural radioisotopes in various parts of the geosphere. Three possible ways are discussed of their formation, viz., the interaction of cosmic radiation with the atmosphere, the interaction of cosmic radiation with the lithosphere, and radioisotopes coming from space. The origination of isotopes ^{26}Al and ^{41}Ca is dealt with in more detail. (INIS)

10843 ACOUSTIC-GRAVITY WAVES IN THE UPPER ATMOSPHERE. Yeh, K. C.; Liu, C. H. (Univ. of Illinois, Urbana). Rev. Geophys. Space Phys.; 12: No. 2, 193-216(May 1974).

The theory of acoustic-gravity waves, the interaction of such waves with the ionosphere, the experimental support for the existence of such waves in the upper atmosphere, and the role played by acoustic-gravity waves in thermospheric dynamics are reviewed. After a thorough discussion on the properties of acoustic-gravity waves in an ideal isothermal atmosphere, the effects produced by horizontal winds, sharp boundary discontinuities, and dissipative processes are discussed. The generation of these waves by stationary or moving sources is then treated. It is shown that the atmospheric response to a stationary impulse source can be described by the emission of three waves: acoustic, buoyancy, and gravity. Propagation effects in a realistic atmosphere for both free waves and guided waves are discussed. Recent numerical results are given. When acoustic-gravity waves propagate through the ionosphere, interaction between the wave and the ionosphere will take place. The physical processes involved in such an interaction are examined. The response of the ionosphere to acoustic-gravity waves can be fairly complex, but its understanding is necessary to interpret various experimental data. The existing experimental data on traveling disturbances are then reviewed. The existence of acoustic-gravity waves throughout the atmosphere implies coupling between the lower atmosphere and the upper atmosphere. Transport of both momentum and energy are accompanied by the wave process. The implication of momentum and energy transport on thermospheric dynamics is discussed. (205 references) (auth)

10844 COSMIC-RAY-PRODUCED ELECTRONS AND GAMMA RAYS IN THE ATMOSPHERE. Daniel, R. R.; Stephens, S. A. (Tata Inst. of Fundamental Research, Bombay). Rev. Geophys. Space Phys.; 12: No. 2, 233-258(May 1974).

The propagation of the primary cosmic radiation through the Earth's atmosphere is a phenomenon of considerable intrinsic complexity stemming from the large number and variety of parameters involved and their dependence on energy, latitude, and atmospheric depth. The hadronic component in the atmosphere has been studied and the electron–photon component has been studied some. As a consequence, the observational data now available on the latter are meager and fragmentary; such information as is available is reviewed and the existing gaps in the knowledge are highlighted. The limited theoretical calculations so far attempted are first reviewed; a summary of detailed calculations recently carried out follows. Results from the calculations are compared with those available from experiments. (113 references) (auth)

10845 IRREGULARITIES IN THE EQUATORIAL IONOSPHERE: THE BERKNER SYMPOSIUM. Farley, D. T. (Cornell Univ., Ithaca, NY). Rev. Geophys. Space Phys.; 12: No. 2, 285-289(May 1974).

E- and F-region irregularities are summarized and discussed. The basic processes generating the E-region (electrojet) irregularities now seem to be understood, but the details are not. Linear plasma instability theory appears to account for the presence or absence of irregularities. However, the irregularity amplitudes, the wavelength distribution, the propagation velocities, etc., all of which depend on nonlinear effects, are not well explained. The question of nonlinear mechanisms is controversial and is being attacked from a number of directions. The F-region irregularities are still poorly understood: the basic driving mechanisms are not yet established. Two new ideas that seem promising involve (1) a gravitational interchange instability involving entire magnetic tubes of force and (2) irregular fingers of metallic ions extending into the lower ionosphere that alter the $E \times B$ drift patterns. (32 references) (auth)

10846 INSTABILITIES AND NONLINEAR PROCESSES IN GEOPHYSICS AND ASTROPHYSICS. Hasegawa, A. (Bell Telephone Labs., Inc., Murray Hill, NJ). Rev. Geophys. Space Phys.; 12: No. 2, 273-280(May 1974).

A review of some nonlinear effects related to plasma instabilities is presented. Discussions are included on (1) quasilinear diffusion, in which a comparison between the effects of electromagnetic and electrostatic turbulence is given; (2) anomalous resistivity, in which a general derivation of the anomalous resistivity is presented and compared with some concrete examples; (3) wave-wave and wave-particle interactions, in which a general theory of parametric instabilities and quenching is presented together with the effects of the nonlinear Landau damping on stabilization of linear instabilities; and (4) modulational instability, in which a general derivation of the instability conditions and the consequence of the instability are discussed. (27 references) (auth)

10847 PHOTOELECTRONS IN THE IONOSPHERE: RADAR MEASUREMENTS AND THEORETICAL COMPUTATIONS. Cicerone, R. J. (Univ. of Michigan, Ann Arbor). Rev. Geophys. Space Phys.; 12: No. 2, 259-271(May 1974).

Ionospheric photoelectrons may be studied by measuring the power returned in the plasma lines of the radar incoherent scatter spectrum. The type and quality of information about photoelectrons available from radar measurements are reviewed. Distinctive capabilities and limitations of this ground-based technique are discussed, and results are presented for a number of plasma-line studies, mostly at Arecibo, Puerto Rico, and Millstone Hill, Massachusetts. These results are compared with measurements by satellite-borne instruments and certain findings of theoretical studies of photoelectrons. It is noted that measured photoelectron escape fluxes generally exceed those predicted by current theories and that inadequate input data for theoretical computations are the likely cause of the discrepancy. Other outstanding problems involving photoelectrons require further research and are described here. One of these is the quantitative evaluation of photoelectron transport and energy degradation in the plasma contained in the magnetospheric field tubes. Experimental and theoretical work is needed to achieve quantitative understanding of protonospheric thermal structure and of predawn temperature and airglow enhancements in the F region of the ionosphere. (72 references) (auth)

10848 AURORAL PARTICLE PRECIPITATION AND BIRKELAND CURRENTS. Arnoldy, R. L. (Univ. of Minnesota, Minneapolis). Rev. Geophys. Space Phys.; 12: No. 2, 217-231 (May 1974).

Correlated measurements that provide information on Birkeland (field aligned) currents are reviewed. Because of the obvious importance of field-aligned electric fields with regard to Birkeland currents, a presentation of recent data on the observations of field-aligned auroral electron fluxes and monoenergetic peaks in the spectrum is made. Experimental data cannot yet define the overall magnetospheric pattern of the Birkeland current system. The largest body of data regarding these currents comes from polar-orbiting satellites. These data indicate that current sheets are associated with auroral displays and that field-aligned electron fluxes on the order of 1-keV energy are significant charge carriers for the conventional current out of the atmosphere. Rocket observations verify that electrons responsible for the production of auroral forms carry a significant fraction of the current necessary to produce local magnetic effects that require Birkeland currents for their explanations. There are a few measurements that suggest that the return current might be carried by low-energy electrons (less than a few hundred electron volts) streaming out of the atmosphere. (36 references) (auth)

10849 RADIATION INTO ANISOTROPIC PLASMA FROM FLANGED PARALLEL-PLATE WAVEGUIDE. Ogawa, Y.; Hongo, K. (Department of Electrical Engineering, Shizuoka University, Hamamatsu, Japan). J. Appl. Phys. 45: No. 6, 2493-2496 (June 1974).

The radiation characteristics of a flanged parallel-plate waveguide in an anisotropic plasma medium are treated as a boundary value problem. Numerical results are presented on the effect of the anisotropic medium on the radiation pattern, the reflection coefficient, and the input impedance for the TEM- and TM_{01}-wave incidence. (auth)

10850 POTENTIAL EXPERIMENTS WITH SUPERCONDUCTING MAGNETS IN EARTH ORBIT. Olson, W. P. (McDonnell Douglas Astronautics Co., Huntington Beach, CA). Space Sci. Rev.; 15: No. 6, 899-904(May 1974).

Several experiments that can be performed in Earth orbit with a superconducting magnet are discussed. They are divided into 2 classes, pure plasma physics experiments that can be performed in near-Earth orbit and planetary magnetosphere simulation ex-

periments that are best conducted in weak background fields distant from the Earth. The later are all based on the Minimag concept where plasma is directed toward a large dipolar magnet in Earth orbit to form a model miniature magnetosphere. Several experiments that cannot be performed in ground based laboratories and tests that cannot be made in the real magnetosphere can be carried out in Earth orbit. The creation of a miniature model of the magnetosphere (Minimag) forms the basis for several of these experiments. (auth)

10851 EFFECT OF THE MOTION OF A PLASMA PARALLEL TO THE MAGNETIC FIELD ON THE LOWER OBLIQUE RESONANCE OBSERVED WITH A QUADRUPOLE PROBE. Pottelette, R. (CNRS, Saint-Maur-des-Fosses, France). Ann. Geophys.; 29: No. 2, 201-226(Apr 1973). (In French).

The lower oblique resonance of a magnetoplasma can be easily observed with a quadrupole probe, the electrodes of which are positioned along a straight line inclined to the direction of the magnetic field. At frequencies in the region of the resonance, the transfer impedance of the probe is affected by the overall relative motion of the plasma electrons. The case where the motion is parallel to the magnetic field is considered. Cold plasma theory is used and a quasi-static hypothesis adopted. The motion attenuates the principal resonance peak, alters its frequency, and leads to secondary peaks. The frequency shift occurs in the opposite direction if the transmitting and receiving functions of the two electrodes of the probe are reversed. The results of the studies conducted enable the velocity of the thermal electron flux parallel to the magnetic field of the magnetosphere to be measured, and thus the contribution of these particles to the field-aligned current. (FR)

10852 DYNAMICS OF THE WINTER POLAR UPPER ATMOSPHERE: UNIVERSAL TIME DEPENDENCE OF THE ELECTRON DENSITY AND THE PEAK OF THE F-LAYER. Moschandreas, D. J. Cincinnati; Univ. of Cincinnati (1973). 128p. University Microfilms Order No. 74-1698.

Thesis (Ph. D.).

The effect of incident electron flux on the behavior of the winter polar ionosphere is investigated by using Green's function and integral equations. The treatment assumes a one dimensional model and includes diffusion, recombination, and production from electron flux. The analytical approach formulated is general and the disturbance function used can vary from production mechanism to photoionization, particle precipitation, thermospheric winds, or passage of gravity waves. The integral equation approach, as opposed to the time-dependent partial differential equation subject to certain boundary conditions, broadens the scope of the investigation and gives simple analytic approximations which provide immediate physical pictures. The degradation of energy of primary soft electrons is investigated from a semi-empirical point of view. The concept of pitch-angle distribution of low-energy incoming electrons is developed, and the oblique incidence of the precipitating fluxes is closely examined. Normalized dissipation functions for oblique flux incidence are obtained and can be used to calculate the ion-pair production for an arbitrary pitch-angle distribution of participating low-energy electron spectra. The lack of photoionization and the maintenance of the F layer of the upper latitudes during the winter is discussed. Different incident electron energy spectra in the soft electron zone outside the polar cavity have been used to compute the steady state electron profiles. It is found that soft electron fluxes can sustain the F layer during the six-months-long dark winter season. The U. T. control of the diurnal variation in the incident electron flux is analyzed using the time variation in the incident energy flux given by Maehlum. The results show U. T. variation in f_0 F2 consistent with observations. It is shown that U. T. variation in the electron flux can also produce variation in h_mF2 which, however, must show correlation with f_0F2 in the absence of other effects. (Diss. Abstr. Int., B)

10853 AURORAL ELECTRON FLUXES PARALLEL TO THE GEOMAGNETIC FIELD LINES. Bosqued, J.M.; Cardona, G.; Réme, H. (Centre d'Etude Spatiale des Rayonnements Université Paul Sabatier, Toulouse, France). J. Geophys. Res. 79: No. 1, 98-104 (1 Jan 1974).

Auroral electron flux characteristics from ~300 eV to 30 keV were measured with twelve detectors launched on the ESRO Skylark rocket S46/1 from Kiruna, Sweden, on November 10, 1969, at ~2346 magnetic local time (MLT) into a breakup aurora. The energetic electrons ($E \gtrsim 5$ keV) displayed isotropic angular distributions during the entire flight, whereas the lowest-energy electrons ($E \gtrsim 5$ keV) were characterized by very anisotropic angular distributions, maximum along geomagnetic field lines when the precipitation was enhanced, $\gtrsim 10^8$ (cm^2 s sr keV)$^{-1}$. The highest value of the ratio between the fluxes measured at 0° and 30° pitch angles was about 40. The energetic and angular distributions thus observed must result from the action of a selective energy mechanism acting mainly on the parallel component of the electron velocity. Experimental results are in agreement with the presence of a parallel electric field along the field lines in the upper ionosphere. (auth)

10854 ON THE MARGINALLY STABLE SATURATION SPECTRUM OF UNSTABLE TYPE I EQUATORIAL ELECTROJET IRREGULARITIES. Lee, K. (Department of Physics, University of California at Los Angeles Los Angeles, California 90024); Kennel, C.F.; Coroniti, F.V.; Kennel, C.F.; Coroniti, F.V. J. Geophys. Res. 79: No. 1, 249-266 (1 Jan 1974).

We formulate a self-consistent convective nonlinear theory of type I irregularities in equatorial electrojet. We find that a combination of three mechanism; convective amplification, quasi-linear polarization electric field reduction, and nonlinear particle orbit diffusion damping, accounts for radar backscatter observations of a ubiquitous marginally stable—or 'constant ion-acoustic Doppler shift'—saturation spectrum better than any of the three mechanisms treated separately. In particular, no spatially homogeneous theory without wave refraction can account for the observations. Wave refraction, quasi-linear polarization reduction, and particle orbit diffusion theory appear to account for type I observations at radar elevation angles less than 60°. Vertical type I backscatter cannot be explained without modifying the present laminar electrojet model. (auth)

10855 INCOHERENT SCATTER RADAR OBSERVATIONS OF WESTWARD ELECTRIC FIELDS AND PLASMA DENSITIES IN THE AURORAL IONOSPHERE, 1. Banks, P.M. (Radioscience Laboratory, Stanford University, Stanford, California 94305); Rino, C.L.; Wickwar, V.B. J. Geophys. Res. 79: No. 1, 187-198 (1 Jan 1974).

This paper reports the results of incoherent scatter radar observations of high-altitude ion drifts and other plasma parameters made February 24, 1972, at Chatanika, Alaska (L=5.7), during a period of magnetic disturbance. For this experiment, conducted between 0909 to 1303 UT (2309 to 0303 AST), the radar line of sight was held fixed in the magnetic meridian plane so that the observed north-south ion drifts could be interpreted in terms of a westward electric field that ranged in magnitude from −10 to+35 mV m^{-1}. The results confirm many effects found previously through other experimental techniques. Southward ion drifts predominated during the 4-hour observation period. Several times the westward electric field inside large regions of enhanced electron density was substantially smaller than the field outside these regions. In addition, on several occasions these walls or bands of ionization were found to drift southward at about the same speed at the $E_z \times B$ drift in the surrounding plasma. The plasma inside the enhanced region, however, did not share the drift motion but remained relatively stationary with respect to the radar. The present observations of F_2 layer densities and temperatures indicate an unusual increase in electron density just before the onset of a large substorm. Finally, measurements of the height and peak density of the auroral E layer show significant variations in the intensity and average energy of the electron flux. These height variations appear to be related to auroral breakup and a transition to steady precipitation of moderately soft electrons. (auth)

10856 HIGH FREQUENCY INDUCED ENHANCEMENTS OF THE INCOHERENT SCATTER SPECTRUM AT ARECIBO, 2. Kantor, I.J. (Department of Space Science, Rice University, Houston, Texas 77001). J. Geophys. Res. 79: No. 1, 199-208 (1 Jan 1974).

When the ionospheric F region is illuminated with a strong O mode HF radio wave, excitations of longitudinal plasma and acoustic waves are observed by 430-MHz radar scattering. The frequency structure of the excited waves and their variability with local parameters, time, and space are described. The observations are interpreted in terms of parametric instability theory. The spectra of the observed features and the correlation of their amplitudes are shown. The upshifted and downshifted plasma lines exhibit some marked asymmetries. Absolute as well as relative amplitudes of the enhancement are presented. (auth)

10857 ATMOSPHERIC SPREADING OF PROTONS IN AURORAL ARCS. Iglesias, G.E.; Vondrak, R.R. (Department of Space Physics and Astronomy, Rice University, Houston, Texas 77001). J. Geophys. Res. 79: No. 1, 280-282 (1 Jan 1974).

A model is developed to calculate the effect of atmospheric spreading on the flux and angular distribution of protons in homogeneous auroral arcs. An expression is derived that indicates the angular distribution in the atmosphere as a function of distance from arc center, neutral scale height, arc width, and initial angular distribution. The results of the model agree favorably with those based on Monte-Carlo calculations. From these results the enhancement factors needed to compute the original proton current above the atmosphere are obtained. A technique is indicated for determining the incident angular distribution from rocket-based measurements of the arc width and angular distribution. (auth)

10858 EQUATORIAL FIELD-ALIGNED IRREGULARITIES DEDUCED FROM THE ECHO-TRAIN AND HYBRID WHISTLERS. Hayakawa, M.; Tanaka, Y. (Nagoya Univ., Toyokawa, Japan). Pure Appl. Geophys.; 111: No. 10, 2336-2340(1973).

10859 CERENKOV RADIATION FROM DISTURBED IONOSPHERE. Agarwal, D. C.; Jain, S. K. (Univ. of Allahabad, India). Indian J. Theor. Phys.; 21: No. 2, 41-47(Jun 1973).

The cherenkov radiation from the abnormally ionized atmosphere is considered. The cherenkov radiated power in the vlf and elf band at mid latitudes is calculated for three disturbed conditions (PCA event, solar flares, and nuclear explosion) and ambient condition of the ionosphere. It is found that due to enhanced ion density during disturbed periods more cherenkov power is radiated in these frequency bands. (auth)

Magnetospheric Phenomena

Refer also to abstracts 9653, 10793, 10816, and 10850.

10860 LABORATORY EXPERIMENTS DIRECTED TOWARD THE INVESTIGATION OF MAGNETOSPHERIC PHENOMENA. Podgorny, I. M.; Dubinin, E. M. (Space Research Inst., Moscow). Space Sci. Rev.; 15: No. 6, 827-840(May 1974).

The penetration of fast electrons (~5 keV) into an artificial magnetosphere and their precipitation on the terrella surface is investigated. These fast electrons act as radioactive tracers allowing the experimental determination of the global picture of plasma flow around the magnetosphere and its intrusion into the latter. Two different zones of precipitation are observed, distinctly separated on the day-side and merging into each other on the night-side. The high latitude penetration region on the day-side is not localized around the neutral points, but is stretched in longitude forming polar cusps toward dusk and dawn. The lower latitude precipitation zone, embracing the whole terrella is due to the particle precipitation from a radiation belt formed in this experiment. The source of these belt particles seems to be located in the plasmasheet on the night side. Besides the polar cusps, a plasma intrusion from the sides of the magnetosphere in the equatorial region is observed. This equatorial gap, originating on the day-side, is gradually transformed into the plasmasheet in the magnetospheric tail. On the basis of these experimental data a model of the magnetosphere is discussed. (auth)

10861 CHARGED PARTICLE MEASUREMENTS ON BOARD THE INTERCOSMOS 5 SATELLITE MADE BY THE PG-1-A APPARATUS. Fischer, S. (Astronomical Inst., Prague); Vesely, V.; Sicha, M.; Laska, L.; Novak, M.; Nemecek, Z.; Studnicka, J.; Hrachova-Rezacova, V.; Tichy, M.; Dubinsky, J. Bull. Astron. Inst. Czech.; 25: No. 2, 69-74(1974).

The electronic PG-1-A apparatus, which was placed on Intercosmos 5, is described. An example of the measurement is presented as well. (auth)

10862 ASSOCIATION OF DP AND DR FIELDS WITH THE INTERPLANETARY MAGNETIC FIELD VARIATION. Kamide, Y. (Geophysical Institute, University of Alaska, Fairbanks, Alaska 99701). J. Geophys. Res. 79: No. 1, 49-55 (1 Jan 1974).

The growth of the geomagnetic DP and DR fields is compared with the corresponding interplanetary N–S component B_z variations. It is found that there is a quantitative difference between substorms with $B_z > 0$ and those with $B_z < 0$. It is also found that for polar magnetic substorms after a period of northward interplanetary field, the auroral electrojet is confined in a rather narrow sector around the midnight meridian. Further, time variations of the interplanetary southward magnetic field are more closely correlated with the growth of the DR field on the earth's surface than with that of the westward auroral electrojet field observed by typical auroral zone stations. This correlation may be due to one or both of the following reasons: (1) the DR field is a better measure of the energy involved in substorms than the DP field; (2) the present network of high-latitude observatories is not always sufficient for monitoring the growth of the auroral electrojet. The different responses of the DR field to whether $B_z > 0$ or $B_z < 0$ may arise from either the true difference in the energy injected into the ring current belt or the difference in distance where the ring current protons are injected. (auth)

10863 REVIEW ON THE USAGE OF MAGNETOSPHERIC MODELS. Gall, R.; Orozco, A. (Instituto de Geofisica, Universidad Nacional Autonoma de México, Mexico City, D.F., Mexico). J Geophys. Res. 79: No. 1, 293-296 (1 Jan 1974).

An important part of theoretical studies on the propagation of cosmic rays in the earth's magnetic domain is based on the simulation of real trajectories performed by numerical integration in model magnetosphere. Some serious misunderstanding and controversy about the usage of magnetospheric models based on Williams and Mead's [1965] expressions have lately appeared in several scientific papers. It is the purpose of this letter to help straighten out the present confusion.(AIP)

10864 ON CORRELATION ANALYSIS OF THE EXPLORER 12 SUBSTORM PROTONS WITH SOME GEOPHYSICAL PARAMETERS. Su, S.; Konradi, A. (NASA Lyndon B. Johnson Space Center, Houston, Texas 77058). J. Geophys. Res. 79: No. 1, 301-304 (1 Jan 1974).

From August to November 1961, when Explorer 12 was located in the noon–dawn quadrant of magnetosphere, 21 cases of steady increases of the proton flux intensities during the substorms were observed.(AIP)

10865 OBSERVATIONS OF THE NIGHTTIME ELECTRON VOLT RANGE ELECTRON FLUXES IN THE EQUATORIAL REGION. Narasinga Rao, B.C.; Singh, R. (Radio Science Division, National Physical Laboratory, New Delhi, India); Maier, E.J. J. Geophys. Res. 79: No. 1, 305-306 (1 Jan 1974).

We report some of the features observed in the nighttime equatorial data of Explorer 31 and indicate their importance to nighttime thermal structure of the topside ionosphere. The nighttime measurements represent the background flux due to magnetospheric particles, since the photoelectrons are absent, owing their very short lifetimes. The thermalization times of photoelectrons, which are mostly in the energy range 10–60 eV, are less than 45 min when the ambient thermal electron density N is 10^3 cm^{-3} and less than 4.5 min when N is 10^4 cm^{-3}.(AIP)

10866 A TEST OF INCOHERENT CERENKOV RADIATION FOR VLF HISS AND OTHER MAGNETOSPHERIC EMISSIONS. Taylor, W.W.L.; Shawhan, S.D. (Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa 52242). J. Geophys. Res. 79: No. 1, 105-117 (1 Jan 1974).

Results of a calculation to ascertain if VLF hiss (several kilohertz to several hundred kilohertz) is explained by incoherent Cerenkov radiation from intense fluxes of electrons (hundreds to thousands of eV) in the magnetosphere are presented. The Cerenkov and cyclotron power emission formulas of Mansfield have been modified to include collisions in order to limit realistically the emitted power and to estimate the spatial attenuation of propagating waves. Ray paths in three dimensions are calculated between the generation region and the observation region where the theoretical power density and fields are evaluated. A comparison is made to a very intense VLF hiss event by using the electron spectrum observed simultaneously with the Injun 5 spacecraft. Although the calculated and observed spectral shapes are in agreement, the power and fields are 2 orders of magnitude too low. It is argued that the source may be a cooperative mechanism, such as partially coherent or amplified Cerenkov emission, which operates in the 3000- to 10,000-km altitude range and which emits waves with initial wave normals near the resonance cone angle ($\gtrsim 80°$ from the magnetic field direction). Incoherent Cerenkov radiation has also been considered as a possible source for several other emission phenomena. Upper hybrid resonance noise and fast hisslers might be understood in terms of this mechanism, although a more detailed calculation is necessary; V-shaped VLF hiss, saucers, ELF hiss, and Io-related Jovian decametric radiation are not explained. Other suggested mechanisms for these phenomena are discussed. Ray-tracing calculation generally confirm the deduced source regions for these various emission phenomena. (auth)

10867 POSTMIDNIGHT CHORUS: A SUBSTORM PHENOMENON. Tsurutani, B.T.; Smith, E.J. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91103). J. Geophys. Res. 79: No. 1, 118-127 (1 Jan 1974).

The ELF (10–1500 Hz) electromagnetic emissions in the midnight sector of the outer magnetosphere have been studied using Ogo 5 search coil magnetometer data. Chorus was detected in conjunction with magnetospheric substorms throughout the region from L=5 to L=9 but only during postmidnight hours. No chorus was seen in the 3 hr preceding midnight even when substorms were in progress. The postmidnight chorus occured only within $\pm 15°$ of, and most frequently at, the geomagnetic equator. Time-averaged intensities varied from 10^{-8} to 10^{-6} γ^2/Hz, which is more than an order below the maximum values reported previously for dayside chorus. The chorus occurred in narrow frequency bands having a bandwidth of 50–200 Hz. Chorus frequencies varied from less than one-fourth to as high as three-fourths of the equatorial electron gyrofrequency as determined by the on-board magnetometer. All frequencies in this range were detected except for a narrow band near one-half the electron gyrofrequency where the chorus appeared to be strongly attenuated. Chorus was often observed as two distinct bands above and below one-half the gyrofrequency. The two most common types of chorus were narrow band chorus without structure and falling tones. Rising tones and hooks were also observed. Chorus pulsations were observed often with quasi-periods of 5–15 s. A correlation was sought, but none was found, between the micropulsations in the ambient magnetic field and the chorus pulsations. Many features of postmidnight chorus can be explained by a cyclotron resonant interaction between the waves and the substorm electrons. The distribution of the chorus as a function of local time and L is strikingly similar to the distribution of enhanced, trapped, and precipitated substorm electrons with energies >40 keV. The postmidnight occurrence of chorus is attributable to the eastward curvature and gradient drift of the injected electrons. Cylcotron resonant interactions should be strongest near the equator, as was observed. The

confinement to within 15° of the equator is attributed to Landau damping by low-energy (1–10 keV) auroral electrons. The attenuation band at one-half the electron gyrofrequency may result from Landau damping by electrons that have energy corresponding to cyclotron resonance but are traveling in the same direction as the waves. A close correspondence is expected between the occurrence of postmidnight and dayside chorus. The maximum in dayside chorus intensity at approximately 1000 LT, which is correlated with the dayside maximum of energetic electron precipitation, may represent further precipitation of the substorm electrons injected near midnight. (auth)

10868 ON THE ENHANCEMENT OF THE WHISTLER MODE INSTABILITY IN THE MAGNETOSPHERE BY COLD PLASMA INJECTION. Cuperman, S. (Cires, University of Colorado, and Space Environment Laboratory, NOAA–ERL, Boulder, Colorado 80302); Landau, R.W. J. Geophys. Res. 79: No. 1, 128-134 (1 Jan 1974).

The modifications in the electron cyclotron electromagnetic (whistler) instability produced by the addition of cold plasma to an infinite uniform anisotropic plasma with parameters similar to those observed in the equatorial magnetosphere at 6.6 R_E are discussed. The discussion is restricted to waves propagating parallel to the static magnetic field. We show that cold plasma greatly increases the growth rate if $P \equiv \beta . A(1+A)^2 \ll 1$, where $\beta = 4\pi n k T_\parallel / B^2$ and $A = (T_\perp/T_\parallel) - 1$. For small values of P the enhancement of the maximum rate of growth is proportional to $\alpha^{-1/2} \cdot \exp(1/2\alpha P)$, where $\alpha = 1 + (n_c/N_w)$ and n_c and nw are the particle densities of the cold and warm electron populations, respectively. There is an optimum value of n_c/n_w for maximum growth rate, i.e., $\simeq 1/P$. The addition of cold plasma also increases the instability range in k space by a factor approximately proportional to $(n_c/n_w)^{1/2}$. The recent confirmation of the analytical results above by numerical solution of the dispersion equation as well as by computer simulation experiments is indicated. (auth)

10869 OPTIMUM COLD PLASMA DENSITY FOR MAXIMUM WHISTLER INSTABILITY: NUMERICAL VERSUS ANALYTICAL. Cuperman, S. (Cires, University of Colorado, and Space Environment Laboratory, NOAA–ERL, Boulder, Colorado 80302); Salu, Y. J. Geophys. Res. 79: No. 1, 135-137 (1 Jan 1974).

Approximate analytical predictions have been given by Cuperman and Landau (1974) for the parallel propagating whistler mode instability in an infinite uniform warm anisotropic plasma in the presence of various amounts of cold plasma. Here the analytical results are compared with exact results that we obtained by solving numerically the corresponding linear dispersion equation. The satisfactory agreement found indicates the reliability of the simple close analytical expressions mentioned above. In particular, the analytical prediction for the optimum cold plasma density for the maximum whistler growth is shown to be in very good agreement with the numerical calculation result. (auth)

10870 PITCH ANGLE EFFECT ON SYNCHROTRON RADIATION FROM ELECTRONS IN THE EARTH'S MAGNETOSPHERE. Peng, S.Y.; Wang, C.S.; Kim, J.S. (Department of Atmospheric Science, State University of New York at Albany, Albany, New York 12222). J. Geophys. Res. 79: No. 1, 138-141 (1 Jan 1974).

A study of the pitch angle effect on synchrotron radiation produced by electrons in helical paths in the magnetopshere has been made for electrons with a pitch angle of $0° < \alpha < 180°$ and an energy of 0.01 MeV $\leq E \leq 7$ MeV in the equatorial plane along a ray path L=1.35. The frequencies and observation angle of interest are 0.1 MHz $\leq f \leq 50$ MHz and 90°, respectively. The synchrotron radiation from a single electron corresponding to different pitch angles and energies is calculated to provide a better understanding of the nature of radiating electrons. The total synchrotron radiation from these electrons is evaluated by using the isotropic, sin α and $\sin^2 \alpha$ pitch angle distributions and the energy spectrum given by Vette et al. (1966). The viewing geometry adopted here is the one previously used by Vesecky and Peterson (1967). It is found that the synchrotron radiation from a single electron is indeed dependent on its pitch angle as well as its energy. And likewise the integrated synchrotron radiation does depend on the electron pitch angle distributions for a given energy distribution. (auth)

10871 ULF PULSATION EVIDENCE OF THE PLASMAPAUSE 1. SPECTRAL STUDIES OF Pc 3 AND Pc 4 PULSATIONS NEAR L = 4. Fukunishi, H.; Lanzerotti, L.J. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Geophys. Res. 79: No. 1, 142-158 (1 Jan 1974).

Power spectra and digital dynamic power spectra of geomagnetic field fluctuations observed at a latitudinal network of stations near L=4 were computed for the entire day of January 5, 1972, in order to study magnetospheric ULF pulsations on a nonstatistical basis. It was found that there are three dominant spectral peaks in the Pc 3–4 frequency range and another peak in the Pc 5 range. The peaks in the Pc 3–4 range are approximately higher harmonics of the spectral peak in the Pc 5 range. The contours of the peak intensities in the spectral bands have been determined as a function of geomagnetic latitude and universal time. These contour maps clearly show that the locations of the intensity maximums of the Pc 3 and Pc 4 peaks gradually change equatorward and poleward in parallel throughout the day and maintain the relationship that the intensity maximum of the Pc 4 peak is always located at a lower latitude than the intensity maximum of the Pc 3 peak. From these observational results it is suggested that the harmonic relationship results from the spectrum of the driving source and that the difference in the location of the intensity maximums of the Pc 3 and Pc 4 frequency bands arises from a sharp decrease in the phase velocity of the Alfvén waves just inside the plasmapause. It is pointed out that these dynamic spectral analyses of Pc 3–4 pulsations near L=4 open the possibility of studying the dynamics of the plasmapause by ground-based ULF techniques. (auth)

10872 SOME FEATURES OF PLASMA DISTRIBUTION IN THE PLASMASPHERE DEDUCED FROM ANTARCTIC WHISTLERS. Park, C.G. (Radioscience Laboratory, Stanford University, Stanford, California 94305). J. Geophys. Res. 79: No. 1, 169-173 (1 Jan 1974).

Whistlers recorded in Antarctica were used to study the plasma distribution in the plasmasphere between L≃2 and 6. Certain features of the plasma distribution can be understood in terms of rapid (~1 day or less) depletion of the plasmasphere during geomagnetic disturbances, followed by slow refilling from the underlying ionosphere. At a given L value, the filling proceeds steadily until the plasmasphere reaches a well-defined density level where an equilibrium with the underlying ionosphere prevails. The time required to reach this equilibrium is related to plasmaspheric tube volume and varies from ~1 day at L=2.5 to ~8 days at L=4. Because of these long recovery times the plasmasphere usually consists of two distinct regions: an 'inner' plasmasphere, which is in equilibrium with the underlying ionosphere over a 24-hr period, and an 'outer' plasmasphere, which is still recovering from the previous disturbance. The monthly median data for June 1965 show that the transition from inner to outer plasmasphere occurred at L≃4.5. In November and December 1964 the transition occurred at L≃4.0, and the density levels were higher than they were in June by factors of 1.5–3. The latter result confirms the existence of large annual electron density variations in the plasmasphere, first discovered by the whistler technique more than a decade ago. (auth)

10873 ON THE DISTRIBUTION OF He^+ IN THE PLASMASPHERE FROM OBSERVATIONS OF RESONANTLY SCATTERED He II 304-Å RADIATION. Paresce, F.; Bowyer, C.S.; Kumar, S. (Space Sciences Laboratory, University of California, Berkeley, California 94720). J. Geophys. Res. 79: No. 1, 174-178 (1 Jan 1974).

The intensity of the He II 304-Å radiation in the night sky was measured from a sounding rocket launched from White Sands Missile Range on June 9, 1972. The data obtained on this flight are compared with predictions of theoretical models of the He^+ altitude distribution within the plasmasphere. The observations are not consistent with an isothermal equilibrium model of the helium ion in the plasmasphere, confirming earlier results. The data are best fit by a diffusive equilibrium model of exospheric He^+ having a plasma temperature gradient of 0.5°K km^{-1} and a number density at 1600 km of 2×10^5 He^+ ions cm^{-3}. In this model the ion densities are calculated without allowance for thermal diffusion. A similar model that allows for thermal diffusion and that has a He^+ number density at 1600 km of 1.5×10^3 cm^{-3} and a temperature gradient of 1.2°K km^{-1} yields a less satisfactory fit to the observations but is more consistent with in situ satellite observations. An empirical power law model in which the ion density decreases as R^{-3} from a value of 6×10^3 He^+ ions cm^{-3} at 1600 km is marginally consistent with the observations. (auth)

10874 EFFECT OF SATELLITE POTENTIAL ON DIRECT ION DENSITY MEASUREMENTS THROUGH THE PLASMAPAUSE. Whipple, E.C.; Warnock, J.M.; Winkler, R.H. (Aeronomy Laboratory, National Oceanic and Atmospheric Administration, Boulder, Colorado 80302). J. Geophys. Res. 79: No. 1, 179-186 (1 Jan 1974).

A simplified theory has been developed for calculating the effect of satellite potential on the ion current measured by an experiment such as an ion mass spectrometer or an ion trap. The theory is based on the use of a spherically symmetric Debye potential distribution in the sheath around the satellite and is particularly appropriate for use in regions where the Debye length is large, such as in the plasmasphere and magnetosphere. Ion data obtained from the ion trap on the Ogo 3 satellite during a pass through the plasmasphere show excellent agreement with the theory. The inferred ion densities from this analysis are as much as 1 order of magnitude different from what would be inferred from previous analyses. (auth)

10875 OBSERVATIONS OF INTERPLANETARY PLASMA WAVES, SPACECRAFT NOISE, AND SHEATH PHENOMENA ON IMP 7. Scarf, F.L.; Fredricks, R.W.; Green, I.M.; Crook, G.M. (Space Sciences Department, TRW Systems Group, Redondo Beach, California 90278). J. Geophys. Res. 79: No. 1, 73-86 (1 Jan 1974).

The Imp 7 plasma wave instrument measures electric and magnetic wave components of plasma oscillations over the frequency range 10 Hz to 100 kHz. We briefly describe the instrumentation and relevant

external characteristics of the spacecraft that appear to be responsible for some in-flight disturbance effects. We show that as each one of the 16 solar panel flats rotates into shadow or sunlight, the array transients produce fluctuating magnetic fields that are detected on the magnetic loop mounted 3.4 m from the spacecraft. These transients occur 16 times per spin period, and the corresponding magnetic noise has a high frequency on the rapidly spinning Imp 7 spacecraft (16f (spin) =12.3 Hz). The analysis suggests that some Imp magnetic threshold levels measured 3–4 m from the spacecraft are determined by the solar array current transient effects associated with the discrete 16-sided geometry of the spacecraft. The geometry also influences the response of the electric dipole antenna by modulating the sheath. External surfaces of the Imp spacecraft are completely nonconducting, so that the photoelectron sheath is highly nonuniform and nonstationary. It is found that local perturbations develop when each one of the 16 columns becomes exposed to sunlight, and the sheath distortions produce a variable effective capacitance for the electric antenna. The in-flight disturbance effects are illustrated with data from quiet intervals in the solar wind, from an eclipse period, and from a period on October 31, 1972, when an interplanetary shock was detected. (auth)

10876 REVIEW OF BASIC COMPUTATIONS WITH SPHERICAL HARMONICS IN GEOMAGNETISM. James, R. W. (Sydney Univ.). Pure Appl. Geophys.; 111: No. 10, 2273-2285(1973).

A number of problems arising in geomagnetism may be successfully solved by using various recurrence relations for spherical harmonic functions. This paper combines these recurrence relations into one simple computational algorithm. The flexibility of the algorithm is illustrated by applying it to the prototype problems of evaluating spherical harmonics and their derivatives, and transforming them under changes of reference frame. (IAA)

10877 SECULAR TREND NEAR THE FOCUS OF MAXIMUM HORIZONTAL INTENSITY. Yacob, A.; Rangarajan, G. K. (Indian Inst. of Geomagnetism, Bombay). Pure Appl. Geophys.; 111: No. 10, 2286-2290(1973).

Secular variations in H at four Indian observatories near the regional focus of maximum horizontal intensity show that a reversal of the increasing trend occurred from about 1965. Broad agreement in the secular trends is seen with some differences in detail. The changes observed at the observatories do not appear to be due to positional shift of the focus. The differences in the trends are attributable to secondary induced current effects in the earth's upper mantle or crust. An apparent long-period variation of 110 years is shown to be part of a much longer period trend. (IAA)

PHYSICS (ATOMIC AND MOLECULAR)

10878 CONCISE DICTIONARY OF PHYSICS AND RELATED SUBJECTS. Thewlis, J. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973). 371p. $16.50.

This dictionary consists of definitions of terms in Physics as well as in a large number of related subjects such as Astronomy, Astrophysics, Aerodynamics, Biophysics, Crystallography, Geophysics, Hydraulics, Mathematics, Medical Physics, Meteorology, Metrology, Photography, Physical Chemistry, and Physical Metallurgy. (MOW)

10879 ATOMIC PHYSICS, PHYSICS OF TRANSIENT PHENOMENA, MOLECULAR PHYSICS, AND PLASMA PHYSICS. Conference held at Stuttgart, Germany, March 4–9, 1974. Abstracts of Papers. Weinheim, Ger.; Physik Verlag GmbH (1974). 170p. (In German and English). (CONF-740329-(Absts.)).

Beams and Their Reactions

Refer also to abstracts 10438, 10921, and 11578.

10880 (AD-771377) GAMBLE 1 PULSED ELECTRON BEAM GENERATOR. Final Report. Cooperstein, G.; Condon, J. J.; Boller, J. R. (Naval Research Lab., Washington, D. C. (USA)). Oct 1973. 14p. (NRL-MR-2671). NTIS $3.00.

The Gamble 1 pulsed electron beam generator at NRL recently has undergone several major modifications. The modified generator has a nominal output into a matched 1.5 ohm load of 500 kA at 750 keV, with a 70 nsec (FWHM) pulse length and a 20 nsec (10 to 90%) voltage risetime. The distinguishing characteristics of low prepulse (<1%) and high reproducibility in output voltage and current (±3%) result primarily from conversion from operation with self breakdown water switches to operation with triggered high pressure gas switches. Fast pulse risetime was maintained by using a low inductance multichannel triggered output switch in conjunction with a new low inductance vacuum diode with a radial insulator. (auth) (GRA)

10881 (IPP-9-16) SCATTERING OF RARE GAS IONS FROM METAL SURFACES. Eckstein, W.; Schaeffler, H. G.; Verbeek, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jan 1974. 29p. Dep. NTIS (US Sales Only) $4.50.

The scattering of rare gas ions from polycrystalline and single crystal metal targets is studied in the energy range of 2 to 16 keV. Three aspects of ion scattering are considered; noble gas ion scattering as an analytical tool for surface analysis, the inelastic energy losses in the scattering processes, and the influence of the crystal structure on the scattering. The last part contains some model calculations to explain the experimental results. (auth)

10882 (ORNL-tr-2813) INTERACTION OF ATOMIC PARTICLES IN THE BULK AND ON THE SURFACE OF A SOLID. Arifov, U. A. (AN Uzbekskoj SSR, Tashkent. Inst. Ehlektroniki). 1972. Translated from Russian. 109p. Dep. NTIS $8.50.

In this compilation are presented the basic results of studies in the field of interaction of ions, electrons, positrons, atoms, and photons with a substance. Problems of secondary ion and electron emission and of cathode dispersion of poly and monocrystals, interaction of multi-charged ions with a substance, changes of the charge on ions when they go through a thin film are discussed. And the theories of the phenomena studied are described, and the multi-electron theory of atoms and molecules are discussed. (auth)

10883 (SLL-74-5225) UPPER AND LOWER BOUNDS ON THE VACUUM PHOTOEMISSION FROM MULTI-DIMENSIONAL SURFACES. Dellin, T. A. (Sandia Labs., Livermore, Calif. (USA)). Mar 1974. Contract AT(29-1)-789. 8p. (CONF-740707-2). Dep. NTIS $4.00.

From annual conference on nuclear and space radiation effects; Fort Collins, Colorado, USA (15 Jul 1974).

It is shown that it is possible to construct rigorous upper and lower bounds on the magnitude of emission from a general convex or concave surface. The superposition approximation is used with the simple and accurate analytical formulas of Dellin and MacCallum. As an example, the important case of the bounds on the emission from a cylindrical wire is considered in detail. (JFP)

10884 (SLL-74-5226) PHOTO-COMPTON CURRENTS AT MATERIAL INTERFACES: THEORY AND EXPERIMENT. Dellin, T. A.; Dolan, K. W.; MacCallum, C. J. (Sandia Labs., Livermore Calif. (USA); Sandia Labs., Albuquerque, N. Mex. (USA)). Mar 1974. Contract AT(29-1)-789. 8p. (CONF-740707-3). Dep. NTIS $4.00.

From annual conference on nuclear and space radiation effects; Fort Collins, Colorado, USA (15 Jul 1974).

The effects of a photon flux incident on the interface between two different materials which generates an electron flux which produced nonlocal energy and charge distributions within an electron range of the interface are investigated theoretically and experimentally. A previous method is extended to determine algebraic formulas for the electron number current, energy current, and energy deposition at the one-dimensional interface between two materials. The electron current at the interface between two similar and dissimilar materials was measured. (JFP)

10885 (SLL-74-5230) ELECTRON BACKSCATTERING AND SECONDARY ELECTRON YIELD MEASUREMENTS FROM DIELECTRIC MATERIALS. Gair, S. (Sandia Labs., Livermore, Calif. (USA)). Apr 1974. Contract AT(29-1)-789. 8p. (CONF-740707-4). Dep. NTIS $4.00.

From annual conference on nuclear and space radiation effects; Fort Collins, Colorado, USA (15 Jul 1974).

Measurements of backscattering coefficients (the fraction of incident electrons backscattered with energy above 50 eV) and secondary electron yields (the number of electrons with energy less than 50 eV emitted per incident electron) are presented. Data are presented for electrons incident on several typical insulators (kapton, mylar, and polyethylene) and graphite as a function of electron energy in the range 8 to 80 keV at 0 to 45 and 60° angle of incidence. Also a comparison is made of the results with detailed Monte Carlo calculations of the albedo, and the relation between the secondary electron emission coefficient and the front surface dose is investigated. (JFP)

10886 (UCID-16500) X-RAY SCATTERING FROM LOW Z MATERIALS: EXPERIMENTAL RESULTS FOR POLYSTYRENE. Tirsell, K. G.; Lent, E. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1974. Contract W-7405-eng-48. 30p. Dep. NTIS $4.50.

Amorphous polystyrene was selected for detailed experimental investigation, and results are presented which were obtained from scattered x-ray measurements using intense high purity incident K_α x-ray beams from 4 to 36 keV. The measured total scattered x-ray intensity (normalized to one incident photon) and scattered x-ray energy distribution are compared with the corresponding results obtained using the Monte Carlo code. (JFP)

10887 (UPTEC-73-28-R) COMPARISON OF ALPHA-PARTICLES AND ^{18}O IONS AS BOMBARDMENT PARTICLES IN ION BACKSCATTERING ANALYSIS. Petersson, S.; Tove, P. A.; Sundqvist, B.; Johansson, A. (Uppsala Univ. (Sweden)). May 1973. 23p. INIS.

For material analysis by ion back-scattering spectrometry the quality of information depends on the type of ions used. Relevant quality factors are mass resolution, depth resolution, depth range of analysis and time of analysis. These factors are analyzed for two types of ions, alpha-particles and ^{18}O ions, considering optimum choice of the energy. For the chosen conditions the result is that ^{18}O ions give better mass and depth resolutions by factors approximately equal to 2.5 and approximately equal to 1.5 to 2, respectively. The depth of analysis for ^{18}O is about ½ of that for alphas. The analysis counting rate for ^{18}O ions is about half of that for alphas. (auth)

10888 EXPERIMENTAL STUDY OF THE FORCED NEUTRALIZATION OF A HYPERSONIC ION BEAM BY THERMAL ELECTRONS. Pomot, C.; Chenevier, P.; Dolique, J. H.; Sermet, P. (Univ., Grenoble, France). Plasma Phys.; 16: No. 6, 533-548(Jun 1974). (In French).

Neutralization of a hypersonic ion beam by the injection of thermal electrons was studied. With the correct adjustment of parameters, neutralization of charge and current was possible. Downstream from the neutralizer, a stationary periodic electric field appeared with characteristics which could be deduced from macroscopic theory, but with an amplitude which decreased rapidly with distance. (auth)

10889 INTERACTION OF AN INTENSE ELECTRON BEAM WITH UNIFORM AND NONUNIFORM PLASMAS. Lut'enko, E. I.; Faynberg, Ya. B.; Vasil'chuk, V. A.; Shepelev, N. P. Fiz. Plazmy Probl. Upr. Termoyad. Sin.; No. 3, 5-15(1972). (In Russian).

Since the method of obtaining intense electron beams by accelerating plasma electrons with an external magnetic field is

a difficult one, the authors have investigated the problem of obtaining such a beam in plasmas which are uniform or non-uniform along their lengths, and they have developed a device for attaining that aim. A diagram of the device and a description of its component parts are given, together with details of its calibration. Experiments were performed for both uniform and nonuniform plasmas; among their results are oscillograms of the plasma radiation and of the electron beam current at various voltages. The experiments showed that there is a limited amount of electron emission from the cold cathode, but this disappears at plasma concentrations of less than $10^{12}/cm^3$. The beam current attains a value of 1000 amp at a 40 kv level, although beams of much higher power can be obtained. (JPRS)

10890 MODEL CALCULATIONS OF ATOM-SURFACE SCATTERING. Flytzanis, N. (Texas Univ., Austin (USA). Dept. of Physics); Celli, V. (Virginia Univ., Charlottesville (USA). Dept. of Physics). Surf. Sci.; 42: No. 1, 173-189(Mar 1974).

The elastic scattering of light mass, thermal-energy atoms from simple surfaces is investigated. The surface is represented by the model of a single planar square array of hard spheres. The effect of the surface potential well is treated semiclassically by simply shifting the energy of the incident atom; furthermore a constant imaginary term is added to the energy to account for inelastic scattering and adsorption. As in the multiple scattering formalism of LEED the total scattering matrix of the lattice is expanded in terms of the individual gas atom-surface atom t-matrices. Propagation of the incident atom on the surface is described in terms of a one-particle Green's function propagator with complex energy. The terms in the multiple scattering series are summed to all orders, by using standard matrix inversion techniques. The size of the matrix to be inverted limits to ten the total number of phase shifts that are included in the calculation. Thermal effects are included through angle dependent Debye-Waller factors. Model calculations have been performed to study the intensity of the specular and the diffracted beams as a function of the angles of incidence. The importance of surface temperature (introduced by the Debye-Waller factors), the incident energy and the depth of the potential well of the gas-surface interaction are discussed. The main feature of the results is the decrease of the intensity of the specular beam in going from glancing incidence to normal incidence and the presence of structure due to the appearance and disappearance of diffracted beams across the surface. The azimuthal behavior of the specular beam is in agreement with experimental observations. (auth)

Atomic and Molecular Properties

Refer also to abstracts 10904, 10958, 10959, and 11449.

10891 (NP-20004) CROSS SECTION OF TWO, THREE, FOUR, AND FIVE-PHOTON IONIZATION OF ALKALI ATOMS. Delone, G. A.; Delone, N. B.; Zolotarev, V. K.; Manakov, N. L.; Piskova, G. K.; Tursunov, M. A. (AN SSSR, Moscow. Fizicheskij Inst.). 1973. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The cross sections of two-, three-, four-, and five-photon direct ionization processes were measured for K and Na during irradiation with laser beams. In each case there is an upper limit imposed by the field intensity. The experimental results are compared with theoretical calculations. (JSR)

10892 PHOTOIONIZATION CROSS SECTIONS: INTERPRETATION OF BAND INTENSITES IN He I AND He II PHOTOELECTRON SPECTRA. Schweig, A.; Thiel, W. (Univ., Marburg, Ger.). JESRA; 3: No. 1, 27-38(Jan 1974).

Relative photoionization cross sections of molecules consisting of atoms from the first three rows of the periodic table are computed by a theoretical method developed previously which involves the plane-wave approximation for the photo-electron and the use of semiempirical LCAO-SCF-MO's of the CNDO- or MINDO-type for the initial orbital. The calculated values are compared with experimental photoelectron band intensities obtained by integrating the band areas in He I and He II photoelectron spectra. The observed relative intensity changes of bands in the spectrum in going from He I to He II excitation are attributed to variations in the one- and/or two-center contributions to the cross sections from the electron density at the atoms and in the bonds, respectively. The analysis of the relative intensities of bands in the He I and He II spectra thus leads to conclusions about the electron density distribution in the initial orbital and about the assignment of the bands. In a qualitative sense, the experimental He I/He II intensity changes are usually correctly predicted by the theoretical method, but there are often considerable quantitative discrepancies between the measured and calculated values which probably arise from the inherent simplifications of the approach. (auth)

10893 MEASUREMENT OF THE ABSOLUTE DIFFERENTIAL CROSS SECTION FOR AUTOIONIZATION FROM THE LEVELS $(2s2p)^3p$ AND $(2s^2)^1S$ OF HELIUM. Gelebart, F.; Tweed, R. J.; Peresse, J. (Brest Univ., France). J. Phys., B (London); 7: No. 6, L174-L178(21 Apr 1974).

An experimental method is described which permits the determination of absolute differential cross sections for the autoionization of helium by electron impact. The analysis of this experiment in terms of the theory of Balashov (Sov. Phys. JETP 63: 1623-3 (1972)) is discussed and illustrated for an incident electron energy of 80 eV. (auth)

10894 FINE STRUCTURE OF THE METASTABLE, c^3P1_u/(1s, 2p), STATE OF MOLECULAR HYDROGEN. Jette, A. N. (Johns Hopkins Univ., Silver Spring, MD). Chem. Phys. Lett.; 25: No. 4, 590-592(15 Apr 1974).

The energy splittings of a single rotational level of metastable parahydrogen have been attributed to spin–orbit, spin–other-orbit and spin–spin interactions. However, there is a discrepancy between this theory and the experimental results in the prediction of the spin–orbit coupling constant. Experiment gives different values for this constant in ortho- and para-hydrogen differing by $2^1/_2\%$. It is shown that when one properly takes into account the spin–rotational interaction between the electrons and nuclear frame work this discrepancy is resolved. (auth)

10895 INFLUENCE OF THE NUCLEAR SPIN ON THE THERMOMAGNETIC TORQUE. Burgmans, A.L.J.; Wang, F.C.; Adair III, T.W. (Department of Physics, Texas A&M University, College Station, Texas 77843). J. Chem. Phys. 60: No. 5, 1732-1739 (1 Mar 1974).

The thermomagnetic torque in rarefied polyatomic gases is a result of the precession of the molecules around the direction of the external field. In the case of a strong magnetic field (Paschen–Back regime) this precession is determined by the rotational angular momentum of the molecules. In weak magnetic fields the angular momentum of diamagnetic molecules is coupled to the nuclear spin which influences the molecular precession and thus the thermomagnetic torque. In this paper experiments on the thermomagnetic torque in HD, n–D_2, and n–H_2 are reported in both strong and weak magnetic fields. Large deviations from an H/p behavior are found as a consequence of the spin coupling. (auth)

10896 IONIZATION ENERGIES OF DOUBLY AND TRIPLY IONIZED LANTHANIDES BY A LINEARIZATION TECHNIQUE. Vander Sluis, K. L.; Nugent, L. J. (Transuranium Research Laboratory, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). J. Chem. Phys. 60: No. 5, 1927-1930(1 Mar 1974).

Linear intraseries correlations of the ionization energies I_3 and I_4 are developed for the gaseous lanthanides. Good agreement is found between our results and previous results, where these ionization energies are more precisely known. Where these ionization energies were less precisely known, we interpolate more precise values, and we offer one explanation of why some of the previous values are slightly higher than our values. (auth)

10897 ANISOTROPY IN THE BEAM–FOIL LIGHT SOURCE. Berry, H.G. (Department of Physics, University of Chicago, Chicago, Illinois 60637); Curtis, L.J.; Ellis, D.G.; Schectman, R.M. Phys. Rev. Lett. 32: No. 14, 751-754 (8 Apr 1974).

We have measured the polarization state of the light emitted in the ^{4}He I, 2s ^{1}S–3p ^{1}P transition after excitation in a beam–foil experiment and find a partial elliptical polarization which depends upon the tilt angle of the carbon foil relative to the beam axis. This indicates that the emergent beam is oriented as well as aligned as a result of an interaction at the foil surface. The relative excitation cross sections and off–diagonal density–matrix elements have been deduced for the angular–momentum sublevels. (auth)

10898 DEACTIVATION OF He 2^3S BY THERMAL ELECTRONS. Nesbet, R. K. (IBM Research Lab., San Jose, CA); Oberoi, R. S.; Bardsley, J. N. Chem. Phys. Lett.; 25: No. 4, 587-598(15 Apr 1974).

The rate coefficient for deactivation of the metastable 2^3S state of He by impact of thermal electrons is deduced from recent calculations of inelastic electron–He cross sections. The deactivation rate is found to be nearly constant with temperature. Computed values range between 2.82 and 3.03 (10^{-9} cm^3/sec) for T between 0 and 2000°K. De-excitation cross sections are given for low energy incident electrons. (auth)

10899 OBSERVATION OF "FORBIDDEN" TRANSITIONS IN He II PHOTOELECTRON SPECTRA. Potts, A. W.; Williams, T. A. (King's Coll., London). J. Electron Spectros. Relat. Phenomena; 3: No. 1, 3-17(Jan 1974).

Anomalous bands are reported in the He II spectra of diatomic

and triatomic molecules which are attributed to excitation of a second electron along with the primary ionization. This dual process is made possible by the mixing of ionized states of the same symmetry but different configurations, i.e., by configuration interaction between ionized states. The close relation between the observed bands and those reported in x-ray spectra which result from the so-called shake-up process is discussed. (auth)

10900 POLARIZABILITY OF A HYDROGEN-LIKE ION WITH AN ARBITRARY NUCLEAR CHARGE. Labzovskii, L. N. Opt. Spectrosc. (USSR) (Engl. Transl.); 35: No. 3, 326-327(Sep 1973).

Translated from Opt. Spektrosk.; 35: No. 3, 561-562(Sep 1973).

The behavior in an external electric field of single-electron single-charge ions in their ground state is examined. (JFP)

10901 EXPECTATION VALUES FOR THE HYDROGEN MOLECULE OBTAINED USING A TRANSCORRELATED WAVE FUNCTION. Armour, E. A. G. (Univ. of Nottingham, Eng.). Chem. Phys. Lett.; 25: No. 4, 614-616(15 Apr 1974).

Expectation values are calculated for the hydrogen molecule using a transcorrelated wave function and the method of Handy and Epstein. (auth)

10902 RADIAL CORRELATION IN ATOMS. Mukherji, A. (Saha Inst. of Nuclear Physics, Calcutta). Pramana; 2: No. 2, 54-61(Feb 1974).

A method is described to calculate correlation energy in atoms. The total wave function of an n-electron system is expressed as a linear combination of products of n one-electron basis orbitals. This function gives a correlated description of the system. Under suitable restrictions it reduced to DODS and to split-shell description of closed-shell atoms or molecules. Energies of He atom, He-like ions and also of H^- ion were calculated including radial correlation only. The calculated electron affinity of H is better than earlier split-shell calculations. The result for He shows that the energy limit for radial correlation was attained. For the other 2-electron ions radial correlation alone explains about one-third of the total correlation. (auth)

10903 CALCULATION OF THE CROSS SECTION FOR THE ELECTRON LOSS BY METASTABLE HYDROGEN ATOMS IN HYDROGEN AND HELIUM. Nikolaev, V. S.; Senashenko, V. S.; Shafer, V. Yu. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 14: No. 6, 737-738(1973). (In Russian).

The cross section for electron loss by metastable hydrogen atoms in hydrogen and helium was calculated and compared with both experimental results and results calculated by a more rigorous method. The comparison showed that in the case of the loss of the 2s electron the agreement of the cross section, calculated by the Born approximation, with experimental cross sections begins at much lower values than in the case of the loss of 1s electrons from the ground state. Calculations made with the sum rule do not agree any more with experimental values than calculations made by the summation of partial cross sections. The precision of the more rigorous calculation is not much better than that of the simple calculation. (JSR)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstracts 10570, 11151, 11507, 11535, 11548, 11549, 11611, 11633, 11644, and 11645.

10904 (INIS-mf-1309) SOME INVESTIGATIONS ON THE QUENCHING OF ORTHOPOSITRONIUM. Bhide, M. G. (Bombay Univ. (India)). 1970. 145p. INIS.

Thesis.

A positronium, a bound system of a positron with an electron, similar to that of hydrogen atom, is formed sometimes by a positron interacting with matter. It may be a singlet which is termed as parapositronium or a triplet which is termed as orthopositronium. The life of orthopositronium is about thousand times that of parapositronium. However, owing to the collisions with atoms and molecules of matter, some of the orthopositroniums are converted into parapositroniums which annihilate immediately. This process is known as "quenching". Quenching processes caused by the scattering of orthopositronium by simple atoms and molecules have been studied theoretically. After examining various possible quenching processes, the processes based on exchange of electrons are accepted as dominant. Exchange quenching cross sections for the various incident energies of orthopositronium were calculated in the Born approximation for hydrogen atom, helium atom, and oxygen molecule. Quenching cross sections were also calculated for the polaron model of the solvated electron in solutions of alkali metals (lithium) in liquid ammonia. A comparison of the calculated values with the experimental ones provides useful information on the electronic structure of the atoms studied. (auth)

10905 (LA-5535-C, pp 184-205) CAPTURE PROCESSES FOR NEGATIVE MESONS. Leon, M. (Los Alamos Scientific Lab., NM). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

Meson capture by atoms and processes leading to the observed x rays are discussed. Also capture in complex systems, crystals, and chemical compounds, and chemical effects on the x-ray spectra is considered. (JFP)

10906 (LA-5535-C, pp 235-246) MUONIUM HOT ATOM CHEMISTRY. Brewer, J. H.; Fleming, D. G. (Univ. of British Columbia, Vancouver). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

The titration technique is used to firmly identify the hot atom component of muonium reactions in solutions of water and methanol. Also a number of pure solvents without added reagents were tested, and their residual polarization was inferred by measuring the observed muon asymmetry. (auth)

10907 (LA-5535-C, pp 247-254) CHEMICAL EFFECTS IN THE CAPTURE OF NEGATIVE MESONS IN MATTER. Knight, J. D. (Los Alamos Scientific Lab., NM). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

An experimental program for the study of chemical effects in negative muon capture is described. The chemical effects of interest are those involving the distribution of captures among the individual elements in chemical compounds (Z law effects) and those involving variations in relative intensities of muonic atom transitions as a function of the chemical environment of the atom. (JFP)

10908 (LA-5535-C, pp 260-278) INVESTIGATIONS ON MESIC CHEMISTRY PERFORMED AT THE LABORATORY OF NUCLEAR PROBLEMS, JOINT INSTITUTE FOR NUCLEAR RESEARCH, DUBNA. Vilgelmova, L.; Dzhuraev, A. A.; Evseev, V. S. (Joint Inst. for Nuclear Research, Dubna, USSR). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

Research on meson chemistry is summarized covering negative pion investigations and a search for structural effects in negative pion capture by complex molecular hydrogen. (JFP)

10909 (LA-5535-C, pp 279-295) PRACTICAL APPLICATIONS OF SIN. Fischer, W. E. (Swiss Inst. for Nuclear Research, Zurich). Mar 1974.

From symposium on practical applications of accelerators; Los Alamos, New Mexico (27 Aug 1973).

In proceedings of the symposium on practical applications of accelerators.

In this talk I shall first give abstracts of a few proposals for practical applications of the SIN-accelerator with negatively charged pions and muons. The main part of this report will, however, be devoted to the investigations, planned at SIN, of solids and fluids by means of depolarization of positive muons. (auth)

10910 (MATSCIENCE-78, pp 118-128) POSITRON ANNIHILATION: A NUCLEAR TOOL FOR SOLID STATE. Ramaswamy, P.; Nagarajan, T.; Devanathan, V.; Narayanaswamy, A. (Univ. of Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The angular distributions from positron annihilation were compared for polycrystalline samples and single crystals. There was no change in the areas under the angular distribution curves. If the mechanism suggested by Dekhtyar were correct the area of the angular distribution curve for the polycrystalline sample must have been more. Therefore, the observations raise doubts about the validity of Dekhtyar's hypothesis. Also an intermediate lifetime is observed in ionic crystals. (JFP)

10911 (ORO-2504-215) MUONIUM FORMATION MEASUREMENT IN DILUTE ARGON GAS. Technical Report No. 74-079. Barnett, B. A.; Chang, C. Y.; Yodh, G. B.; Carroll, J. B.; Eckhause, M.; Hsieh, C. S.; Kane, J. R.; Spence, C. B. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1973. 14p. Dep. NTIS $4.00.

Direct precession measurements of the muonium atomic system were made in argon gas at low pressures of 1290 and 2280 torr. At the higher pressure the probability of muonium formation was found to be (85 ± 9)%, and a lower limit to the muonium relaxation time to be 2.8 ± 0.8 μsec. This rate of formation is in agreement with that predicted by Firsov and Byakov on the basis of muonium energy thresholds. (auth)

10912 POSITRON ANNIHILATION IN ALKALI METALS. Hipolito, O.; Lobo, R. (Instituto de Fisica e Quimica, Sao Carlos, Brazil). Nuovo Cim., 21B: No. 1, 182-194(11 May 1974).

An effective electron-positron interaction is obtained by the canonical transformation method. Positron annihilation rates in metals are calculated, and the possibility of formation of positronium for such effective potential is discussed. An alternative interpretation for the positron annihilation rates in alkali metals is presented assuming the existence of positronium even at metallic densities. (auth)

10913 INTENSITIES AND STRONG INTERACTION ATTENUATION OF KAONIC X-RAYS. Backenstoss, G.; Egger, J.; Koch, H.; Povel, H. P.; Schwitter, A.; Tauscher, L. (CERN, Geneva). Nucl. Phys., B73: No. 2, 189-201(1974).

Relative intensities of numerous kaonic x-ray transitions have been measured for the elements C, P, S, and Cl, from which level widths due to the strong K-nucleus absorption have been determined. From these and earlier published data, optical potential parameters have been derived and possible consequences on the nuclear matter distribution are discussed. (auth)

10914 POSITRON ANNIHILATION IN TRANSITION METALS. Shrivastava, S. B.; Dubey, V. S. (Univ., Vikram, Ujjain, India). Lett. Nuovo Cim.; 10: No. 2, 52-54(11 May 1974).

Annihilation rates for the metals Fe, Co, Ni, and Cu considering the annihilation with valence as well as with core electrons are calculated. The contribution of d-shell electrons to the annihilation process and hence the mechanism of positron annihilation in transition metals was studied. The effectiveness of the 3d electrons in the annihilation process was found to be correlated to the half-width of the 3d band. It is concluded that the contribution from the core electrons are important for understanding the annihilation process and that the probability of annihilation with the core electrons is a function of the bandwidth and its position relative to the Fermi level. (JFP)

10915 POSITRON ANNIHILATION IN ZrO_2: ANGULAR CORRELATION. Tsuda, N.; Mitsuhashi, T.; Chiba, T. (National Inst. for Researches in Inorganic Materials, Ibaraki, Japan). J. Phys. Soc. Jap.; 36: No. 2, 523-525(Feb 1974).

Angular correlation curve of powdered monoclinic ZrO_2 was taken and compared with some calculated curves. It is expected that the wave function of oxygen 2s electron extends more outwards than that used. (auth)

10916 EFFECT OF MULTIVACANCIES ON POSITRON ANNIHILATION IN Cu. Sueoka, O. (Tokyo Univ.). J. Phys. Soc. Jap.; 36: No. 2, 464-469(Feb 1974).

Using the temperature dependence of the peak value in the angular correlation, the formation energy of a monovacancy in Cu and the effects of multivacancies on the peak value were obtained. The formation energy of a monovacancy, E_F^{1v}, is $E_F^{1v} = 1.20 \pm 0.07$ eV. The representation of the trapping model in plural trapped states is given in a similar formulation to the conventional trapping model, and it was applied to the data analysis. (auth)

10917 EFFECT OF A NEUTRAL INTERMEDIATE BOSON ON THE HYPERFINE SPLITTING OF MUONIUM. Grotch, H. (Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802). Phys. Rev. D 9: No. 1, 311-312 (1 Jan 1974).

The effect of a massive neutral intermediate boson on the hyperfine splitting of muonium is shown to be negligible in Weinberg's SU(2) × U(1) model. This conclusion does not agree with the prediction made in a recent paper by Repko on the same subject. (auth)

10918 NEUTRAL-BOSON EFFECTS IN MUONIUM. Repko, W.W. (Department of Physics, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. D 9: No. 1, 313-313 (1 Jan 1974).

The absence of a term which depends linearly on the vector boson mass in the expression for the muonium hyperfine interval is confirmed, in agreement with the result reported by Grotch. (auth)

Collision Phenomena

Refer also to abstracts 9314, 10898, 11260, and 11483.

10919 (INIS-mf-1248) GLORY UNDULATIONS IN THE TOTAL CROSS SECTION FOR SCATTERING OF HEAVY RARE GAS ATOMS. Bredewout, J. W. (Rijksuniversiteit Leiden (Netherlands)). 12 Sep 1973. 128p. INIS.

The total cross sections for scattering of argon and krypton beams by argon, krypton and xenon in the velocity range from 550 to 4300 m s^{-1} were measured. The results have to lead to a more precise determination of the rare gas interaction potentials. In the design of the experimental equipment one has tried to approximate as nearly as possible the ideal situation. The influence of the remaining deviation from the ideal situation is discussed. Those potentials which are based mainly upon differential cross section data yield extreme velocities which are too low and absolute values for the total cross sections which are too high. The reduced BFW-potential (Barker, Fisher and Watts) for Ar-Ar and the reduced BB-potential (Bobetic, Barker) for Kr-Kr differ not more than 4% for r/r_m larger than 0.74, while the reduced BAR-potential for Ar-Kr is the average of these two. (auth)

10920 (NP-19999) ANNUAL REPORT, 1972–1973. (Interuniversitair Reactor Instituut, Delft (Netherlands)). [nd]. 93p. (In Dutch). Dep. NTIS (US Sales Only) $7.75.

Experimental and theoretical studies made in molecular physics, magnetism, Moessbauer effect, reactor physics, chemistry, and health physics and dosimetry are outlined. A list of publications and reports issued is appended. (J8R)

10921 (ORO-3027-23) EXCITATION AND IONIZATION OF IONS BY ELECTRON IMPACT. Technical Progress Report, September 1, 1973–May 31, 1974. Feeney, R. K.; Divine, T. F.; Hooper, J. W.; Kovac, R. M.; McPherson, D.; Sayle, W. E. (Georgia Inst. of Tech., Atlanta (USA). School of Electrical Engineering). 31 May 1974. Contract AT(40-1)-3027. 32p. Dep. NTIS $4.75.

Four different but closely related experimental programs are covered. These are (a) absolute measurements of the cross sections for the ionization of Tl^+, Cs^+, and Rb^+ ions by electron impact over the range of incident electron energies from below threshold to approximately 2000 eV; (b) the determination of the absolute cross sections for input excitation by electrons with energies from near threshold to 5 to 20 times threshold of electric dipole transitions for the 2^3S-2^3P multiplet in the helium-like B^{3+} and C^{3+} ions; (c) the refinement and extrapolation of the experimental techniques used in (b) so as to facilitate the determination of electron impact excitation cross sections for additional members of the helium and lithium isoelectronic sequences; (d) an investigation of the aluminosilicate thermionic-type ion sources for use in collision experiments; and (e) use of previously developed magnetoplasma transient response apparatus to measure the momentum elastic scattering cross sections for electrons in argon gas. Item (d) is undertaken as a subpart of (a) while item (e) represents a terminal activity under this program but is included to illustrate typical results and usefulness of the technique. A list of publications is included. (auth)

10922 (SLA-74-107) RELATIVISTIC, ELASTIC ELECTRON SCATTERING FROM ATOMS AT ENERGIES GREATER THAN 1 keV. Riley, M. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1974. Contract AT(29-1)-789. 33p. Dep. NTIS $4.75.

The theoretical program developed to calculate elastic electron-atom cross sections over an extensive range of energy, from a few hundred volts to the megavolt region. The cross sections are based on the static approximation and they are compared with experiments when available. A new exchange approximation is developed and compared to more elaborate theory, and the overall importance of exchange and polarization corrections to the static approximation is investigated in the kilovolt region. Independent-atom-model calculations for N_2 and CO are compared to experiment at 500 eV. (auth)

10923 VIBRATIONALLY INELASTIC SCATTERING OF $H^+ + H_2$. Collins, F. S.; Preston, R. K.; Cross, R. J. (Yale Univ., New Haven). Chem. Phys. Lett.; 25: No. 4, 608-610(15 Apr 1974).

Using an ab initio potential-energy surface and both classical trajectories and a semiclassical approximation, differential and total cross sections were calculated for $H^+ + H_2$ ($\nu = 0$) → $H^+ + H_2$ ($\nu' = 0,1,2$) at an initial c.m. energy of 10 eV. The results compare well with the experiments of Udseth et al. (auth)

10924 UNIFORM EVALUATION OF THE S MATRIX FOR ELASTIC AND INELASTIC COLLISIONS IN SEMICLASSICAL COLLISION THEORY. Connor, J. N. L. (Univ. of Manchester, Eng.). Chem. Phys. Lett.; 25: No. 4, 611-613(15 Apr 1974).

The relation between the Airy and Bessel uniform approximations for one-dimensional S matrix integrals in semi-classical collision theory is investigated. It is shown how the Airy uniform approximation can be obtained from the Bessel uniform approximation as a special case. The calculations extend previous work by Stine and Marcus on this topic. (auth)

10925 EXCESS KINETIC ENERGIES OF IONIZATION PRODUCTS OF ELECTRON IMPACT PROCESSES. Levin, G.; Platzner, I. (Nuclear Research Centre–Negev, Beer–Sheva, Israel). J. Chem. Phys. 60: No. 5, 2007-2011 (1 Mar 1974).

The excess kinetic energies of negative and positive fragment ions produced by electron impact were determined by best fitting of calculated ion decay curves to the measured ones. The most probable kinetic energies of the ions only were calculated assuming Gaussian–like, or Maxwell–Boltzmann energy distributions. The results for $O^+(O_2)$, $O^-(N_2O)$, $N_2^+(N_2O)$, and $S^-(COS)$ are in good agreement with other reported data. (auth)

10926 EFFECTIVE POTENTIAL FORMULATION OF MOLECULE–MOLECULE COLLISIONS WITH APPLICATION TO H_2–H_2. Zarur, G.; Rabitz, H. (Department of Chemistry, Princeton University, Princeton, New Jersey 08540). J. Chem. Phys. 60: No. 5, 2057-2078 (1 Mar 1974).

Coupled equations and cross section expressions are derived for the collision of two distinguishable and two identical molecules. A previously developed effective potential (Hamiltonian) formulation of molecular collisions is used throughout this paper. A semiclassical analysis of the total and differential cross sections is presented as an extension of previous elastic scattering studies. The semiclassical analysis is used to discuss conditions for significant quantum statistical oscillations in the elastic and inelastic identical molecule cross sections. Close coupling calculations for collisions of para–para, ortho–ortho, and ortho–para hydrogen up to E = 0.725 eV are presented as an illustration of the general formulation. Various aspects of the H_2–H_2 potential are investigated. In particular, the different roles of the long– and short–range anisotropies are illustrated. Both total and differential cross sections are presented for a number of transitions. The identical molecule inelastic differential cross sections show considerable quantum statistical oscillations, particularly in para–para hydrogen. The degree of quantum statistical interference is shown to depend on the specific transition considered. The nature and desirability of certain experimental measurements is discussed with regard to determining the energy and angular dependent behavior of the cross sections. (auth)

10927 ABSOLUTE DIFFERENTIAL CROSS SECTIONS OF ELASTICALLY SCATTERED ELECTRONS. V. O_2 AND CO_2 AT 500, 400, AND 300 eV. Bromberg, J.P. (Department of Chemistry and Mellon Institute, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213). J. Chem. Phys. 60: No. 5, 1717-1721 (1 Mar 1974).

Absolute differential cross sections of electrons elastically scattered by O_2 and CO_2 were measured at energies of 500, 400, and 300 eV over the angular range of 2° to 40°. In both cases the cross sections become independent of the momentum change in the limit of small momentum change, and polarizabilities were calculated. (auth)

10928 CALCULATED LONG–RANGE INTERACTIONS AND LOW ENERGY SCATTERING OF Ar–H. Wagner, A.F.; Das, G.; Wahl, A.C. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). J. Chem. Phys. 60: No. 5, 1885-1891 (1 Mar 1974).

The long–range interaction potential in Ar–H is evaluated through the use of the multi–configuration–self–consistent–field (MCSCF) method. The values of C_6 and C_8 obtained by analysis of the dispersion terms in this potential agree with previous calculations and estimates. The potential is used to calculate the total elastic cross sections for low energy hydrogen–argon scattering. These results support only one of the two conflicting experimental measurements reported in the literature. (auth)

10929 ION–X–RAY COINCIDENCE EXPERIMENTS IN SLOW Ne^+–Ne COLLISIONS. Sackmann, S.; Lutz, H.O.; Briggs, J. (Kernforschungsanlage Jülich, D–517 Jülich, West Germany, and Universität Köln, D–5 Köln, West Germany). Phys. Rev. Lett. 32: No. 15, 805-808 (15 Apr 1974).

Ne^+ ions of 235 and 363 keV primary energy are scattered from a dilute Ne gas target. Ne K x rays excited in these collisions are detected in coincidence with ions scattered through laboratory angles ranging from 3 to 36°. The impact–parameter dependence of inner–shell excitation thus derived matches well with the Briggs–Macek theory. (auth)

10930 TERM–WISE ANALYSIS OF THE GLAUBER EIKONAL SERIES. Yates, A. C. (Indiana Univ., Bloomington). Chem. Phys. Lett.; 25: No. 4, 480–486(15 Apr 1974).

For the case of charged particles colliding with atoms, an analytical procedure capable of providing quantitative estimates of the Glauber cross section is proposed. (auth)

10931 MODEL CALCULATIONS OF HARPOONING ELEMENTARY PROCESSES IN THE SYSTEM K + Br_2. Havemann, U. (Central Inst. of Physical Chemistry, Berlin); Zuelicke, L.; Nikitin, E. E.; Zembekov, A. A. Chem. Phys. Lett.; 25: No. 4, 487–492(15 Apr 1974).

The dynamics of nonadiabatic elementary processes in the system K + Br_2 (exchange reaction, electron transfer, dissociation) are investigated using the quasiclassical trajectory method. Based on an estimation of the transition probability from the covalent to the ionic potential surface, the treatment is restricted to a calculation of the motion (1D, 2D, and 3D) on the ionic potential which is represented by a model function. Differential and total cross sections are determined, briefly discussed and compared with molecular–beam data. (auth)

10932 EFFECT OF TERNARY COLLISIONS IN THE PRESSURE BROADENING THEORY OF SPECTRAL LINES OF ATOMS. II. Application to the $6S_{\frac{1}{2}} \rightarrow 6^2P_{\frac{3}{2}}$ Caesium Line Perturbed by Argon. Czuchaj, E. (Univ., Danzig). Acta Phys. Pol.; A45: No. 5, 731–748(May 1974).

The analysis of the influence of the ternary collisions on the atomic line shape is continued. In particular, it is shown that appropriate averaging over the momenta of the second perturber can be performed by means of integration over the three Euler angles and—what is especially important in concrete calculations—this integration may be reduced in some cases to an integral over one angle. Furthermore, the corresponding classical functions for the real and imaginary parts of the ternary collision term of the relaxation matrix are obtained in a form appropriate for direct computation. The preliminary numerical results concerning the resonance line of caesium broadened by argon are presented. It is also pointed out that the corresponding Fano's expansion of the relaxation matrix is ill–defined because of its divergence in the line center in the classical path approximation. (auth)

10933 APPLICATION OF INTEGRAL FORM OF CLOSE COUPLING EQUATIONS TO ATOMIC SCATTERING. Ghosh, A. S.; Basu, D. (Indian Association for the Cultivation of Science, Calcutta). Indian J. Phys.; 47: No. 12, 765–768(Dec 1973).

An integral form of the close coupling method was applied to investigate the scattering of electrons and positrons by hydrogen atoms neglecting rearrangement channels and the excitations of the target atom. It was found that the effect of polarization is dominant in the low energy region. (JFP)

10934 PROGRAMMING PACKAGE FOR THE CALCULATION OF CROSS SECTIONS AND PROBABILITIES FOR CHARGE–EXCHANGE PROCESSES. van den Bos, J. (Univ. of Nebraska, Lincoln). Comput. Phys. Commun.; 7: No. 3, 163–171(Mar 1974).

The computer program IPEVAIJ written in FORTRAN for the IBM 360/65 is described for the probabilities and cross sections for atom and molecule collisions in which one of the particles captures an electron from the other one. The method is restricted to relative kinetic energies appreciably larger than the energy deficit of the reaction. (JFP)

10935 ENERGY, STRUCTURE, AND REACTIVITY. Proceedings of the 1972 Summer Research Conference on Theoretical Chemistry, Boulder, Colorado, June 26–30, 1972. Smith, D. W.; McRae, W. B. (eds.). New York; John Wiley and Sons, Inc. (1973). 416p. (CONF–7206101–). $14.95.

The conference covers atomic and molecular processes of scattering, theoretical models for chemistry, semiclassical quantum mechanics and statistical exchange, electron correlation: ab initio methods, density matrices, the status of many–body methods in chemistry, atom–atom interactions, excited states and electron binding energies, large molecules: ab initio techniques, and the status of large molecule quantum chemistry. (JFP)

10936 DISTORTED WAVE STUDY OF THE PLANAR HYDROGEN EXCHANGE REACTION: H + $H_2 \rightarrow H_2$ + H. Walker, R. B. Austin, TX; Univ. of Texas (1973). 124p. University Microfilms Order No. 74–5343.

Thesis (Ph.D.).

The distorted wave Born approximation is used to study the quantum dynamics of the hydrogen exchange reaction for collisions in which the three hydrogen nuclei move on a single plane throughout the reaction. The reactant and product molecular wave functions are approximated by the product of a perturbed stationary state Morse vibrational wave function and a generalized hindered rotor torsional wave function. The calculations emphasize the threshold energy range, since distorted wave cross sections overestimate reactivity at high energies. Consequently, both the initial and final molecules are in their lowest vibrational state, but several rotational transitions are investigated. The distorted wave Born approximation is used to obtain elements of the scattering matrix (S–matrix), from which reaction probabilities, angular distributions of products (the differential cross section), and the total reaction cross section may be determined. A method is proposed for using these planar (2D) S–matrix elements as averaged three dimensional (3D) S–matrix elements, from which 3D differential and total reaction cross sections may be calculated.

The reaction probabilities show that the greatest probability of reaction occurs at low impact parameters. Both the 2D and 3D differential cross sections show back peaking, implying that the product molecule recedes in the direction from which the incoming atom approached. The 2D and 3D cross sections agree qualitatively with the results of other calculations. At low energies, the DWBA $0 \rightarrow 1$ total cross section is in close (perhaps fortuitous) agreement with the 3D results of Wolken and Karplus. At higher energies, the expected "blowup" behavior is seen as the distorted wave approximations to the T matrix becomes evident. (Diss. Abstr. Int., B)

10937 ELECTRICAL BREAKDOWN IN GASES. Rees, J. A. (ed.). New York; John Wiley and Sons, Inc. (1973). 300p.

The discussion of electrical breakdown in gases covers the various kinds of discharges as well as ionization. (JFP)

10938 STABILITY CONCEPTS IN THE NUMERICAL SOLUTION OF CLASSICAL ATOMIC AND MOLECULAR SCATTERING PROBLEMS. Brumer, P. (Harvard Univ., Cambridge, MA). J. Comput. Phys.; 14: No. 4, 391-419(Apr 1974).

Stability concepts arising in the numerical solution of ordinary differential equations are reviewed in order to analyze their role in the classical solution of atomic and molecular scattering problems. Treatment of dynamically stable systems is shown to require consideration of the integrator's absolute stability range while treatment of dynamically unstable systems primarily requires the use of stable integrators with small truncation errors. The stability properties of a variety of model scattering problems are considered and restrictions due to absolute stability requirements are related to characteristic frequencies of the system. Dynamic instability due to long range attractive interactions as well as in collinear $H + H_2$ collisions is also discussed. The time dependent eigenvalues of the stability matrix are given for several atom–harmonic oscillator and collinear $H + H_2$ sample trajectories. (auth)

10939 DESTRUCTION OF FAST METASTABLE HYDROGEN ATOMS PASSING THROUGH ATOMIC HYDROGEN. Bell, K. L.; Kingston, A. E. (Queen's Univ., Belfast). J. Phys., B (London); 7: No. 6, L171-L173(21 Apr 1974).

The first Born approximation is used to calculate the cross section for destruction of fast hydrogen metastable atoms, H(2s), passing through ground state atomic hydrogen. These theoretical results are in good agreement with the measurements of Gilbody and Corr (J. Phys. B. Atom. Molec. Phys. (in press)) for impact energies greater than 50 keV. (auth)

10940 ELASTIC SCATTERING USING THE FIXED SCATTERING CENTERS APPROXIMATION FOR A SYSTEM OF IDENTICAL PARTICLES. Benoist-Gueutal, P. (Paris Univ., Orsay, France). J. Phys. (Paris); 34: No. 11, 943-949(Nov 1973). (In French).

The extension of the fixed scattering centers approximation to the three identical particle problem is studied. The existence of an ambiguity is demonstrated. The application of a three boson system interacting by the intermediate of separable two-body potentials indicates that the numerical consequences of this ambiguity are small at high energy. (auth)

10941 INNER SHELL IONIZATION CROSS SECTIONS FOR RELATIVISTIC ELECTRONS. Seif el Nasr, S. A. H.; Berenyi, D.; Bibok, G. (Magyar Tudomanyos Akademia Atommag Kutato Intezete, Debrecen, Hungary). Z. Phys.; 267: No. 3, 169-174 (Apr 1974).

The cross section of electron impact ionization was determined for the K-shell in the case of the elements Ni, Y, Ag, Yb, Ta, Au and Pb at 670 and 490 keV as well as for the L-shell in the case of the elements Yb and Pb at 670, 490 and 350 keV, and in the case of Ta at 670 and 490 keV. The results are compared with the theoretical calculations and the earlier experimental results. (GE)

10942 DIFFERENTIAL CROSS SECTION FOR ROTATIONAL TRANSITION IN LOW-ENERGY HD–He COLLISIONS. Itikawa, Y. (Tokyo Univ.). J. Phys. Soc. Jap.; 36: No. 1, 254-258(Jan 1974).

By using the close-coupling method, differential cross sections are calculated for the elastic scattering and the rotational excitation ($0 \rightarrow 1$) in the He-HD collision. The calculation is carried out for relative kinetic energies of 0.014, 0.02, and 0.04 eV. The cross section for the rotational excitation shows a gradual peaking in the backward direction. This and other qualitative features of the angular dependence of the cross sections are discussed in terms of the interaction potential used. (auth)

10943 LOW ENERGY ION-NEUTRAL REACTIONS. III. $Ar^+ + NO$, $Kr^+ + NO$, $Ar^+ + O_2$, $Kr^+ + O_2$, AND $Ar^+ + CO$. Kobayashi, N. (Tokyo Metropolitan Univ.). J. Phys. Soc. Jap.; 36: No. 1, 259-266(Jan 1974).

Molecular asymmetric charge transfer reactions in the systems Ar^+-No, Kr^+-NO, Ar^+-O_2 Kr^+-O_2 and Ar^+-CO were studied by an injected-ion drift tube technique in the energy range from 0.04 to 3 eV. All reactions have large cross sections in spite of the large exothermicities, and each of them has a minimum. The cross sections in the low energy part have $E^{-\frac{1}{2}}$ dependences when the reactant is NO, while they have E^{-1} dependences when the reactant is O_2 or CO. An hypothesis is proposed to explain the large cross sections, but without quantitative treatment. (auth)

10944 EFFECTIVE POTENTIAL FORMULATION OF MOLECULE-MOLECULE COLLISIONS WITH APPLICATION TO H_2–H_2. Zarur, G.; Rabitz, H. (Department of Chemistry, Princeton University, Princeton, New Jersey 08540). J. Chem. Phys. 60: No. 5, 2057-2078 (1 Mar 1974).

Coupled equations and cross section expressions are derived for the collision of two distinguishable and two identical molecules. A previously developed effective potential (Hamiltonian) formulation of molecular collisions is used throughout this paper. A semiclassical analysis of the total and differential cross sections is presented as an extension of previous elastic scattering studies. The semiclassical analysis is used to discuss conditions for significant quantum statistical oscillations in the elastic and inelastic identical molecule cross sections. Close coupling calculations for collisions of para–para, ortho–ortho, and ortho–para hydrogen up to E = 0.725 eV are presented as an illustration of the general formulation. Various aspects of the H_2–H_2 potential are investigated. In particular, the different roles of the long- and short–range anisotropies are illustrated. Both total and differential cross sections are presented for a number of transitions. The identical molecule inelastic differential cross sections show considerable quantum statistical oscillations, particularly in para–para hydrogen. The degree of quantum statistical interference is shown to depend on the specific transition considered. The nature and desirability of certain experimental measurements is discussed with regard to determining the energy and angular dependent behavior of the cross sections. (auth)

10945 IONIZATION CROSS SECTIONS IN THE MODIFIED FIRSOV THEORY. Komarov, F.F.; Kumakhov, M.A. (Institute of Nuclear Physics, Moscow). Sov. Phys.–Tech. Phys. 18: No. 7, 847-850 (Jan 1974).

A study is made of the modified Firsov theory for calculating inelastic energy losses in ion–atom collisions, allowance being made for the shell structure of the colliding particles. If the modified Firsov theory is to agree with experimental data for close collisions, it is necessary to allow for the energy of transitions that take place with definite probabilities and are associated with the formation of interior vacancies. In the calculation of the ionization cross sections allowance is made for the distribution (given in ref.1) of the energy of excitation of the outer shells between ionization losses and the energy carried away by electrons. It is shown that the curves calculated in accordance with the modified Firsov theory for the ionization cross sections as functions of the velocity of the incident ion reflect the individual features of the interacting particles. (auth)

10946 METHOD FOR MEASURING THE EFFECTIVE IONIZATION CROSS SECTION IN ION–ATOM COLLISIONS. Latypov, Z.Z.; Shaporenko, A.A. (A. F. Ioffe Physicotechnical Institute, Leningrad). Sov. Phys.–Tech. Phys. 18: No. 7, 994-995 (Jan 1974).

A new method for measuring the effective ionization cross section in ion–atom collisions is described. The method uses the large difference in the amplitudes of electron and ion oscillations in the same high–frequency field to separate electrons and ions and to detect electrons. (auth)

10947 ANGULAR DISTRIBUTION AND FORM OF RESONANCE LINES OF PHOTOELECTRONS. Balsahov, V. V.; Kabachnik, N. M.; Sazhina, I. P. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 14: No. 6, 733-734(1973). (In Russian).

The examination of the photoionization of Ne showed that the effects discussed–change of the profile of the resonance lines of the photoelectrons with the ejection angle and the abrupt change of the coefficient of angular anisotropy in the resonance region–can be very significant under actual conditions. Graphs calculated from matrix elements obtained earlier were given for Ne. (JSR)

10948 ELASTIC SCATTERING OF He^+ AND N^+ ON THE HEAVIER RARE GAS ATOMS. Mittmann, H. U. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). (1973). vp.

From conference on ion molecule reactions; Berlin, Germany (11 Apr 1973).

The rainbow structure and the Stueckelberg oscillations were measured for the following systems: He^+–Ne, He^+–Ar, He^+–Kr, He^+–Xe, N^+–Ar, N^+–Kr, and N^+–Xe. The differential cross sections for elastic scattering were compared with quantum-mechanical calculations, taking into account adiabatic and diabatic potentials as well as weighted transition probabilities according to LANDAU-ZENER. (GE)

10949 ELASTIC SCATTERING OF THE SYMMETRIC RARE GAS ION–RARE GAS ATOM SYSTEMS. Mittmann, H. U. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). (1973). vp.

From conference on ion molecule reactions; Berlin, Germany (11 Apr 1973).

A rainbow structure and g-u interferences were observed. The asymptotic state in Ne^+-Ne splits up into 4 different states, due to 2 different MO's both splitting further into a g and a u term. Measurements were made for the elastic differential cross sections of the systems Ne^+-Ne, Ar^+-Ar, Kr^+-Kr and Xe^+-Xe at different energies, ranging from about 1 to 30 eV. Various calculations of quantum-mechanical partial wave analysis were carried out for comparison with experimental results. (GE)

Atomic Theory

Refer also to abstracts 10900 and 11767.

10950 (ORNL-tr-2814) AUGER EFFECT. Parilis, E. S. (AN Uzbekskoj SSR, Tashkent. Inst. Ehlektroniki). 1969. Translated from Russian. 146p. Dep. NTIS $10.50.

The various phenomena of the Auger effect are emphasized. Its variations are discussed; and the basic ideas and facts are outlined. Attention is drawn to foreign work. (JFP)

10951 (SLA-74-212) SIMPLE MODEL OF SUPERRADIANCE. Riley, M. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1974. Contract AT(29-1)-789. 16p. Dep. NTIS $4.00.

The discussion of superradiance covers the Dicke systems for a two-level gas of atoms or molecules and the rate equation approximation. (JFP)

10952 STUDY OF THE ELECTRON GAS APPROXIMATION. Kim, Y.S.; Gordon, R.G. (Department of Chemistry, Harvard University, Cambridge, Massachusetts 02138). J. Chem. Phys. 60: No. 5, 1842-1850 (1 Mar 1974).

We test the applicability to atoms of the uniform electron gas energy expression in terms of the local atomic electron density. By using the known atomic electron densities obtained from an independent method (Hartree–Fock) for the density in the electron gas energy expression, we calculate some atomic energies, one-electron energies, and atomic ionization potentials and compare the results with the Hartree–Fock energy values. We calculate the local kinetic energy and exchange energy densities in Hartree–Fock atoms, and compare these results with the corresponding electron gas energy densities. We suggest a simple correction to the electron gas energy to be used for systems not paired in spin, and test this correction. We examine the effect of the finiteness of the atoms by treating the uniform electron gas with a finite number of electrons. (auth)

10953 FINITE DIFFERENCE NEWTON–RAPHSON SOLUTION OF THE ATOMIC HARTREE–FOCK PROBLEM. Cayford, J. K.; Fimple, W. R.; Unger, D. G. (Univ. of Cantebury, Christchurch, New Zealand). J. Comput. Phys.; 15: No. 1, 81-97(May 1974).

The SCF iteration is coupled with a finite difference Newton-Raphson algorithm to solve the set of coupled second-order integrodifferential equations with split boundary conditions which constitutes the atomic HF problem. In the new method the two-point boundary conditions at $r = 0$ and $r = \infty$ as well as the Lagrange multipliers are incorporated into a large system of nonlinear algebraic equations which are solved by means of a generalized Newton–Raphson iteration which converges rapidly and efficiently. The need to estimate initial slopes of the radial functions and values of Lagrange multipliers was completely eliminated. As an example a calculation of the $1S^22S$ open-shell configuration of Li is presented. Through the use of Richardson extrapolation an accuracy of nine significant figures was achieved. The new method is easier to apply and more versatile than the conventional methods. Although only Li and Be were attempted so far (each with complete success) the method can certainly handle very large systems. (auth)

10954 ANISOTROPY OF THE g-FACTOR OF AN ATOMIC SYSTEM INTERACTING WITH ROTATING AND OSCILLATING RADIO-FREQUENCY FIELDS. Zverev, V. V.; Pokazanev, V. G. Opt. Spectrosc. (USSR) (Engl. Transl.); 35: No. 3, 328-330(Sep 1973).

Translated from Opt. Spektrosk.; 35: No. 3, 564-567(Sep 1973).

It was previously shown that the interaction of an atom in a constant magnetic field with a radiofrequency (rf) oscillating with a frequency perpendicular to the magnetic field direction causes substantial changes in the atomic g-factor in the direction of the constant field if the frequency is much greater than a given frequency. In this discussion one of the two rf fields is considered to be rotating. This allows conversion to a new system of coordinates and makes it possible to take its effect on the system into account exactly. In the calculations of the second rf field, limitations are imposed only on its frequency. (JFP)

10955 THEORY OF THE INTERSYSTEM RADIATIONLESS TRANSITIONS. Svishchenko, V. V.; Terpugova, A. F. (Tomsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 62-67(1973). (In Russian).

A comparison was made of two limiting cases of the use of the spin-orbital perturbations H_{so} in the theory of intersystem radiationless transitions (immediate when H_{so} taken directly behind the perturbation and when H_{so} is considered in the wave functions, but the nonadiabaticity of H_H is a perturbation). A numerical evaluation of the relative probability of $W(H_{so})/W(H_H)$ of radiationless transitions was made for these limiting cases. (tr-auth)

10956 WKB APPROXIMATION IN THE MOMENT ANALYSIS OF ATOMIC LINE SHAPE. Bielski, A.; Szudy, J.; Wolnikowski, J. (Nicholas Copernicus Univ., Torun, Poland). Acta Phys. Pol.; A45: No. 5, 761-772(May 1974).

The moments of pressure-broadened spectral lines are evaluated on the basis of the Jabloński quantum-mechanical theory using the WKB wave functions. Numerical calculations were performed for the Cs-resonance line perturbed by helium and by argon assuming the Lennard–Jones potential. Comparison with experiment as well as with the classical theory of Jacobson is presented. (auth)

10957 HARTREE–FOCK EVALUATION OF SPECIFIC-MASS ISOTOPE SHIFTS. Bauche, J. (CNRS, Orsay, France). J. Phys. (Paris); 35: No. 1, 19-26(Jan 1974).

Following a previous paper on the 3d series, specific-mass isotope shift are computed, by means of the nonrelativistic Hartree–Fock method, in atoms of the 4d, 4f, 5d and 5f series, in the alkalis and in a few two- and three-electron spectra. In heavy atoms, when isotopic measurements of muonic x-ray transition lines are available, direct comparisons with experiment are presented for optical transitions with large specific shifts. In the other cases, through the use of King diagrams, the comparison is made between the Hartree–Fock (HF) and experimental values of some known linear combination of the specific shifts of two lines. In all nl^N long series, the HF and experimental values agree within a factor of two. This gives confidence in the main HF result, i.e. the prediction that the lines with the jump of an nl electron have by far the largest mass shifts. (auth)

10958 MULTIPOLE SCREENING OF NUCLEI OF HYDROGEN-LIKE ATOMS. Zapryagaev, S. A.; Manskov, N. L.; Rapoport, L. P. (Voronezh State Univ., USSR). Yadern. Fiz.; 19: No. 5, 1136-1139(May 1974). (In Russian).

The analytical expression for the multipole screening factors of the nuclei of hydrogen-like atoms in electric and magnetic fields is obtained which includes exactly the relativistic corrections. The nonrelativistic limits and expansions up to the terms of the $(\alpha Z)^2$ order are considered. The effect of the relativistic corrections $\sim(\alpha Z)^4$ on the ratio of g factors of bound and free protons is discussed. (auth)

10959 RADIATIVE CORRECTION TO ATOMIC LEVELS FROM MUON AND FROM HADRON VACUUM POLARIZATION PHENOMENA. Iwao, S. (Kanazawa Univ., Japan). Progr. Theor. Phys. (Kyoto); 50: No. 5, 1748-1750(Nov 1973).

An estimation is given of the radiative correction to the atomic levels from hadron vacuum polarizations. Hydrogen-like atoms are considered. (JFP)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

10960 PROPAGATION OF THREE-DIMENSIONAL WAVES IN MAGNETOGASDYNAMICS WITH HEAT RADIATION. Vacca, J. Atti Accad. Sci. Torino. I. Cl. Sci. Fis., Mat. Natur.; 107: No. 6, 699-713(1973). (In Italian).

The propagation of small-amplitude three-dimension waves in an electrically conducting non-viscous gas, initially at rest and then exposed to a uniform magnetic field was studied. The effect of the radiative heat flux was taken into consideration. The plane waves are considered and the unknowns are completely determined in some particular cases in which the dispersion equation is solved. (tr-auth)

10961 SPHERICAL HARMONIC ANALYSIS OF THE NAVIER-STOKES EQUATION IN MAGNETOFLUID DYNAMICS. Frazer, M. C. (Alberta Univ., Edmonton (Canada)). Phys. Earth Planet. Inter.; 8: No. 1, 75-82(Feb 1974).

The equation of motion (Navier-Stokes equation) for a uniformly rotating, compressible, magnetic, viscous fluid is analyzed in terms of infinite series of spherical surface harmonics. Differential equations are obtained for the radial functions of the poloidal and toroidal harmonics of the velocity, corresponding to those obtained by Bullard and Gellman for the magnetic field from the electromagnetic induction equation. This new analysis opens the way for the dynamical problem of electromagnetic induction in the earth's core to be considered by the spherical harmonic method. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 11048, 11049, and 11070–11075.

10962 (UCSB-10-P-23-26) HIGH ENERGY USER GROUP AT SANTA BARBARA. Progress Report, May 1973–March 1974. Caldwell, D. O. (California Univ., Santa Barbara (USA)). 1974. Contract AT(11-1)-Gen-10. 13p. Dep. NTIS $4.00.

Research activities on experimental high energy physics are summarized. Papers written, talks given, and budget expenditures are listed. (JFP)

10963 DESIGN CRITERIA FOR A GENERAL PURPOSE HIGH-ENERGY PHYSICS EXPERIMENT SIMULATION PROGRAM. Vaccari, E. (Istituto Nazionale di Fisica Nucleare, Bari, Italy); Delaney, W. Comput. Phys. Commun.; 7: No. 3, 135-144(Mar 1974).

Criteria for determining the logical structure and functions of a program for the simulation of high energy physics experiments are discussed. An analysis which reveals the characteristic properties of systems used for the realization of such experiments and the kinds of objectives which typically motivate their simulation is carried out. (auth)

Electromagnetic

10964 (DESY-74-11) PHOTOPRODUCTION OF ρ^0, ω AND ρ-MESONS ON DEUTERONS AT ENERGIES BETWEEN 1 AND 5 GeV. Benz, P.; Braun, O.; Butenschoen, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Mar 1974. 43p. Dep. NTIS (US Sales Only) $5.25.

The reactions $\gamma d \to \rho^0 d$, $\gamma d \to \omega d$, and $\gamma n \to \rho^- p$ were investigated in a deuterium bubble chamber experiment at DESY with a bremsstrahlung beam of 5.5 GeV maximum energy. Effective mass distributions as well as total and differential cross sections are presented. The results are compared with ρ^0 and ω production on protons. (auth)

10965 (JINR-E1-7756) PROTON ELECTROMAGNETIC FORM FACTOR AND HEAVY HYPOTHETICAL PARTICLES. Bilenkaya, S. I.; Bilen'kii, S. M.; Kazarinov, Yu. M.; Lapidus, L. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 8p. Dep. NTIS (US Sales Only) $4.00.

The experimental data on e-p elastic scattering were analyzed. Simple pole parametrizations of form factors were found which make it possible to fit all the data available. A possible influence of the hypothetical gluon on the form factor is discussed. (auth)

10966 (LNF-73-11) ANALYSIS OF THE MEASUREMENT OF THE SINGLE PHOTOPRODUCTION COLLISION CROSS SECTION. Part III. π^- of the 500 MeV Threshold. Patriarca, F. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). 3 Apr 1973. 48p. (In Italian). Dep. NTIS (US Sales Only) $5.50.

A statistical analysis of the data on the single photoproduction relative to the collision cross section of π^- is made. The data obtained are tabulated and compared with the experimental data on the π^-/π^+ ratio, data from absolute measurements, and data on the total collision cross section. (JSR)

10967 (PIB-1-217) ELECTROPRODUCTION OF ETA-MESONS. Beck, U.; Becks, K. H.; Bukert, V. (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Aug 1973. 6p. INIS.

The reaction $e^- + p \to e^- + p + \eta$ was studied in the region of the $S_{11}(1535)$-resonance by detecting the recoil proton in coincidence with the scattered electron. The reaction was observed at three four-momentum transfers of the virtual photon: $q^2 = -0.2$, -0.28, and -0.4 (GeV/c)^2. First results of the differential cross section measurements are given. (GE)

10968 (PIB-1-218) FORWARD π^+ ELECTROPRODUCTION IN THE REGION OF THE $\Delta(1236)$ AT A FOUR-MOMENTUM TRANSFER OF Q^2 ABOUT 0.3 (GeV/c)^2. Baetzner, K.; Beck, U.; Becks, K. H. (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Aug 1973. 4p. INIS.

The reaction $e^- + p \to e^- + n + \pi^+$ was studied in the region of the $\Delta(1236)$ resonance at a four momentum transfer of the virtual photon of about 0.3 (GeV/c)^2. Angles and momenta of the secondary electron and of the outgoing pion were measured obtaining the angular distribution of the pion for cm angles between 10 and 40°. The data are compared with some theoretical calculations. (orig.) (GE)

10969 (PIB-1-219) π^0 ELECTROPRODUCTION AT THE $\Delta(1236)$ RESONANCE AND AT A FOUR-MOMENTUM TRANSFER OF q^2 ABOUT 0.3 (GeV/c)^2. Baetzner, K.; Beck, U.; Becks, K. H. (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Aug 1973. 11p. INIS.

The reaction $e^- + p \to e^- + p + \pi^0$ was studied in the region of the $\Delta(1236)$ resonance at a four-momentum transfer of the virtual photon of 0.3 (GeV/c)^2. Angles and momenta of the secondary electron and of the outgoing proton were measured in coincidence to obtain the angular dependence of the differential cross section. The angular distribution for s- and p-waves of the pion in the π-N-CM-system was fitted to the cross section for three W-bins around the maximum of the resonance. The contribution of the resonant multipoles M1+, E1+, and S1+ to the cross section as well as the contribution of the background amplitudes M1-, E0+, and S0+ are given. (GE)

10970 DIRECT ELECTRON-PAIR PRODUCTION BY 200-GeV PROTONS. Jain, P.L.; Kazuno, M.; Girard, B.; Ahmad, Z. (High Energy Experimental Laboratory, Department of Physics, State University of New York at Buffalo, Buffalo, New York 14214). Phys. Rev. Lett. 32: No. 14, 797-800 (8 Apr 1974).

Forty directly produced electron pairs have been found by following 713.4 m of 200-GeV-proton track length in nuclear emulsion. For these pairs we have analyzed (i) the total energy distribution, (ii) the energy partition between the two members, (iii) the angular divergence, (iv) the transverse momentum distribution, and (v) the invariant mass of the electron pairs. Present theories disagree with our experimental results. (auth)

10971 NEUTRAL PION PHOTOPRODUCTION FROM HYDROGEN AT FORWARD ANGLES IN THE ENERGY RANGE 350 TO 1175 MeV. Maki, A. (Kyoto Univ.). Mem. Fac. Sci., Kyoto Univ.). Mem. Fac. Sci., Kyoto Univ., Ser. Phys., Astrophys.; 34: No. 2, 161-182(Feb 1973).

The differential cross sections near zero degree of the reaction $\gamma p \to \pi^0 p$ in the energy range from 350 to 1175 MeV were measured by detecting two photons from π^0 mesons. The angular dependences of the differential cross sections from zero degree to 50° in the cm system at about 600 and 1000 MeV were also measured with the same method. The data were analyzed with with the similar method of Walker's partial wave analysis. This analysis required a rather large contribution of P_{11} wave in π^0 meson photoproduction from protons. (auth)

10972 ANOMALOUS ORBITAL MAGNETISM REVEALED IN MAGNETIC MOMENTS OF HIGH-SPIN STATES. Yamazaki, T. (Tokyo Univ.). J. Phys. Soc. Jap., Suppl.; 34: 17-29(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Empirical evidences for the mesonic anomaly in the orbital g factors (δg_l) are discussed, which have been provided by recent extensive measurements of magnetic moments of high-spin isomeric states. Whole empirical data have revealed systematically $\delta g_l(p) = 0.10 \sim 0.20$ and $\delta g_l(n) = 0.05 \sim -0.15$, which are in good agreement with the prediction of Miyazawa ($\delta g_l \simeq 0.10\tau_3$) based on the one-pion exchange current. It is found that in the ^{208}Pb region the magnitude of $\delta g_l(n)$ is appreciably smaller than that of $\delta g_l(p)$, being consistent with the fact that $N > Z$. (9 figures, 1 table) (auth)

10973 ANALYSIS OF π^+, π^-, AND π^0 PHOTOPRODUCTION FROM THE FIRST THROUGH THE THIRD RESONANCE REGION. Moorhouse, R.G. (Department of Natural Philosophy, Glasgow University, Glasgow, Scotland); Oberlack, H.; Rosenfeld, A.H. Phys. Rev. D 9: No. 1, 1-41 (1 Jan 1974).

A continuous-energy partial-wave analysis of 4148 data points on the processes $\gamma p \to \pi^+ n$, $\gamma p \to \pi^0 p$, and $\gamma n \to \pi^- p$ in the range of center-of-mass energy from 1160 to 1780 MeV has been made. The method used is parameterization of resonances and background in the imaginary parts of the amplitudes, with the real parts being calculated from fixed-t dispersion relations, thus ensuring a proper treatment of the Born terms. It is found that the imaginary parts of the amplitudes are resonance dominated, though not resonance saturated. Many $N^*N\gamma$ couplings (of both isospin-1/2 and isospin-3/2 resonances, N^*) are determined for the first time. A comparison of the signs and magnitudes of the various resonance formation partial-wave amplitudes (depending on the product of the $N^*N\gamma$ and $N^*N\pi$ couplings) is made to the predictions of the essentially parameterless naive quark model. The critical comparison of the signs is found to be extremely favorable

to that model, while there is an over-all qualitative agreement in magnitude.

10974 ELECTRON–POSITRON ELASTIC SCATTERING AT 5 GeV CENTER-OF-MASS ENERGY. Newman, H.; Averill, R.; Eshelman, J.; Law, L.; Law, M.E.; Leong, J.; Little, R.; Mieras, H.; Strauch, K.; Tarnopolsky, G.; Wilson, R.; Winick, H. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 and Cambridge Electron Accelerator, Cambridge, Massachusetts 02138 and Harvard University, Cambridge, Massachusetts 02138 and Technion–Israel Institute of Technology, Haifa, Israel). Phys. Rev. Lett. 32: No. 9, 483-485 (4 Mar 1974).

We have measured the cross section, the distribution of scattering angles, and the distribution of noncoplanarity angles for electron–positron elastic scattering at 5 GeV c.m. energy. An analysis based on 230 events with scattering angles between 50 and 130° yields a ratio of the experimental to theoretical quantum-electrodynamic cross section of 1.03 ± 0.09. The scattering-angle and noncoplanarity-angle distributions are also found to be in excellent agreement with the quantum-electrodynamic predictions. (auth)

Weak

10975 (COO-3072-13) MEASUREMENT OF THE CHARGE ASYMMETRY IN $K_L^0 \to \pi^\mp e^\pm \nu$ DECAYS. Webb, R. C. (Princeton Univ., N. J. (USA). Elementary Particles Lab.). Jun 1972. Contract AT(11-1)-3072. 97p. Dep. NTIS $8.00.

Thesis.

Using a magnetic spectrometer with multiwire proportional chambers for track definition, approximately $96*10^6$ $K_L^0 \to \pi^\mp e^\pm \nu$ events were observed. From these K_{e3} decays the asymmetry in the decay rates for the two charge configurations was measured. This asymmetry was observed with three different mass configurations in the detector and an extrapolation to zero mass was performed. The result of this measurement is $\delta = \{[\Gamma(K_L^0 \to e^+\pi^-\nu) - \Gamma(K_L^0 \to e^-\pi^+\nu)]/[\Gamma(K_L^0 \to e^+\pi^-\nu) + \Gamma(K_L^0 \to e^-\pi^+\nu)]\} = (2.66 \pm .34)*10^{-3}$. In terms of the parameters ϵ is usually used to parameterize CP violation in the neutral K system this result leads to a measure of $Re\epsilon = (1.33 \pm .17)*10^{-3}$ in the limit that $\Delta S = -\Delta Q$ amplitudes are zero. The most recent results for $|\eta_{+-}|$, $|\eta_{00}|$, and their phases, ϕ_{+-} and ϕ_{00}, lead to a predicted $Re\epsilon$ of $Re\epsilon = (1.45 \pm .09)*10^{-3}$. (auth)

10976 (COO-3072-17) MEASUREMENT OF THE K_S CONTENT OF THE K^0 STATE AND THE BRANCHING RATIO BETWEEN THE K_S 2π DECAYS. Technical Report No. 5. Sager, D. J. (Princeton Univ., N. J. (USA). Elementary Particles Lab.). Dec 1972. Contract AT(11-1)-3072. 147p. Dep. NTIS $10.50.

Thesis.

The K^0 meson state is a superposition of the short-lived and long-lived states, K_S and K_L. The K_S component decays principally to charged or neutral pion pairs. By observing the production of an ensemble of K^0's and the decay of K_S^0s the proportion of K_S in the K^0 state, and the branching ratio between the charged and neutral two-pion decay modes of the K_S were determined. The value $R(K_S \to \pi^+\pi^-)/R(K_S \to \pi^0\pi^0) = 2.22 \pm 0.08$ was found. Within the framework of a phenomenological theory, the amount of K_S overlap with the K^0 state is a test of CPT invariance of the weak Hamiltonian. The results, in excellent agreement with CPT invariance, yield for the usual CPT violating parameter $Re\ \delta = -0.0014 \pm 0.0075$. (auth)

10977 (IFVE-SEF-72-72) RECONSTRUCTION OF NEUTRINO SPECTRUM IN DETECTORS BY MUON FLUX DISTRIBUTION IN SHIELDING IN IFVE NEUTRINO EXPERIMENT. Bugorskii, A. P.; Goryachev, V. N.; Mukhin, A. I.; Sviridov, Yu. M.; Stroganov, Yu. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 18p. (In Russian). INIS.

This study estimates the errors in establishing the neutrino spectrum from measurements of muon fluxes in the shielding under conditions of the IHEP neutrino experiment. There is a brief discussion of the experimental equipment and also of the advantages and shortcomings of other methods of establishing the neutrino spectrum. (SJR)

10978 (JINR-P1-7892) MEASUREMENT OF THE POSITIVE MUON LIFETIME. Balandin, M. P.; Grebenyuk, V. M.; Zinov, V. G.; Konin, A. D.; Ponomarev, A. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 18p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.00.

The mean lifetime of the positive muon at rest was measured and found to be $(2.19711 \pm 0.00008\ \mu s)$. The decay positrons were detected with a Cerenkov water counter. Its radiator was simultaneously a target at which center muons stopped. The 4π-detector geometry and the high detector efficiency allowed the increase of the counting rate and the suppression of some undesirable effects. The experiment has been performed at the Laboratory of Nuclear Problems, JINR. (auth)

10979 (ORO-2504-188) WIDE-GAP SPARK CHAMBER STUDY OF $K_L^0 \to \pi^\pm + e^\mp + \nu$ DECAY. Technical Report No. 73-033. Wang, L. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Aug 1971. 141p. Dep. NTIS $10.25.

Thesis.

A wide-gap spark chamber operated in a magnetic field of 10 KG was used to measure the energy dependence of the form factor $f_+(q^2)$ in $K_L^0 \to \pi^\pm + e^\mp + \nu$ decay. Decays of K_L^0 meson in a vacuum box were detected in the –30° neutral beam of the AGS at Brookhaven National Laboratory. K_{L3}^0 decays were identified by electromagnetic showers produced in a lead radiator plate between the two 12-inch gaps of the chamber. The linear parameter λ_+ of the form factor $f_+(q^2)$ is determined to be 0.040 ± 0.013 where the error includes possible systematic errors. A variety of other forms for the energy dependence were also studied. (auth)

10980 (ORO-2504-213) MEASUREMENTS OF THE BETA-DECAY PROPERTIES OF THE Λ HYPERON. Technical Report No. 74-044. Katz, C. N. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Dec 1973. 172p. Dep. NTIS $11.75.

Thesis.

There were 1075 lambda beta decay events, $\Lambda \to pe^-\bar{\nu}e$, in a sample of approximately 1.1×10^6 charged lambda decays produced by a beam of K^- mesons stopping in the 30" hydrogen bubble chamber at the Brookhaven National Laboratory AGS. For the branching ratio of the $A\beta$-decay mode the value $(0.82 \pm 0.04) \times 10^{-3}$ is found. For the value of the ratio of the axial vector form factor to the vector form factor used in describing the V-A hadronic interaction current the value $g_1/f_1 = (0.73^{+0.0}_{-0.0})$, and with 95% confidence limits $0.58 \le g_1/f_1 \le 0.95$ are found. From this branching ratio, axial vector to vector form factor ratio, the Λ lifetime and the CVC value of weak magnetism, f_2/f_1, the Cabibbo angle was calculated to be equal to (0.242 ± 0.020). The analysis was corrected to eliminate the effects of the imposition of acceptance criteria, as well as the biases introduced during the detection and processing. The form factor ratio g_1/f_1 is insensitive to weak magnetism, f_2. The inclusion of second-class currents, via axial weak magnetism, g_2, results in a family of solutions for g_1/f_1; no unique solution can be found. (auth)

10981 OBSERVATION OF MUONLESS NEUTRINO-INDUCED INELASTIC INTERACTIONS. Benvenuti, A.; Cheng, D.C.; Cline, D.; Ford, W.T.; Imlay, R.; Ling, T.Y.; Mann, A.K.; Messing, F.; Piccioni, R.L.; Pilcher, J.; Reeder, D.D.; Rubbia, C.; Stefanski, R.; Sulak, L. (Department of Physics, Harvard University, Cambridge, Massachusetts 02138 and Department of Physics University of Pennsylvania, Philadelphia, Pennsylvania 19174 and Department of Physics, University of Wisconsin, Madison, Wisconsin 53706 and National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. Lett. 32: No. 14, 800-803 (8 Apr 1974).

We report the observation of inelastic interactions induced by high-energy neutrinos and antineutrinos in which no muon is observed in the final state. A possible, but by no means unique, interpretation of this effect is the existence of a neutral weak current. (auth)

10982 SEARCH FOR $K_L^0 \to \pi^+\pi^-\gamma$. Woo, C.; Buchana, C.; Pepper, D. (Univ., California, Los Angeles). Lett. Nuovo Cim.; 10: No. 2, 38-40(11 May 1974).

A stringent set of criteria were applied to 450,000 raw events of K_L^0 decays in search for the $\pi^+\pi^-\gamma$ decay. One event was found to pass all criteria. Assuming the one event to be real, the efficiency of identifying $\pi^+\pi^-\gamma$ events combined with the total number of decays yielded a branching ratio of 2.3×10^{-4} with 25% uncertainty from systematic effects. (LBS)

10983 PROPERTIES OF Ξ^- AND Ξ^0 HYPERONS. Baltay, C.; Bridgewater, A.; Cooper, W.A.; Gershwin, L.K.; Habibi, M.; Kalelkar, M. (Columbia University, New York, New York 10027); Yeh, N.; Gaigalas, A. Phys. Rev. D 9: No. 1, 49-62 (1 Jan 1974).

We report a measurement of the Ξ and Ξ^0 weak-decay parameters, mean lifetimes, and spins, based on 4303 Ξ^- and 652 Ξ^0 decays. We find for the Ξ^-, $\alpha = -0.376 \pm 0.038$, $\phi = 11° \pm 9°$, $\tau = (1.63 \pm 0.03) \times 10^{-10}$ sec, and spin equal to 1/2 with higher spins excluded by more than 7 standard deviations; for the Ξ^0, $\alpha = -0.54 \pm 0.10$, $\phi = 16° \pm 17°$, $\tau = (2.88^{+0.31}_{-0.19}) \times 10^{-10}$ sec, and spin equal to 1/2 with higher spins excluded by more than 4 standard deviations. The results are consistent with the requirements of T invariance, and they are in fair agreement with the $\Delta I = 1/2$ rule. (auth)

10984 MUON–PROTON DEEP INELASTIC SCATTERING. Entenberg, A.; Jöstlein, H.; Kostoulas, I.; Melissinos, A.C. (University of Rochester, Rochester, New York 14627); Lederman, L.M.; Limon, P.; May, M.; Rapp, P.; Gittleson, H.; Kirk, T.; Murtagh, M.; Tannenbaum,

M.J.; Sculli, J.; White, T.; Yamanouchi, T. Phys. Rev. Lett. 32: No. 9, 486-489 (4 Mar 1974).

We have measured muon–proton deep inelastic scattering in the range $0.4 < q^2 < 3.6$ (GeV/c)^2. The data are consistent with muon–electron universality, and if the ratio $\rho = \nu W_2(\mu\text{-}p)/\nu W_2(e\text{-}p)$ is fitted with the form $\rho = N(1+q^2/A^2)^{-2}$, we obtain $N = 0.997 \pm 0.043$ and $A^{-2} = +0.006 \pm 0.016$ (GeV/c)^2. This result establishes that $|A| \geq 5.1$ GeV/c with 95% confidence. (auth)

10985 MUON–PROTON DEEP ELASTIC SCATTERING. Kostoulas, I.; Entenberg, A.; Jöstlein, H.; Melissinos, A.C.; Lederman, L.M.; Limon, P.; May, M.; Rapp, P.; Gittleson, H.; Kirk, T.; Murtagh, M.; Tannenbaum, M.J.; Sculli, J.; White, T.; Yamanouchi, T. (University of Rochester, Rochester, New York 14627, and Columbia University, New York, New York 10027, and Harvard University, Cambridge, Massachusetts 02138 and National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. Lett. 32: No. 9, 489-493 (4 Mar 1974).

We have measured muon–proton elastic scattering in the range $0.6 < q^2 < 3.2$ (GeV/c)^2. We compared these data with the corresponding elastic electron–proton cross sections by forming the ratio $r(q^2) = G^2(\mu\text{-}p)/G^2(e\text{-}p)$, where $G(q^2) = G_M(q^2)/\mu$ is the form factor of the proton. By fitting $r(q^2) = N(1+q^2/A^2)^{-2}$ we find $N = 1.043 \pm 0.080$ and $A^{-2} = +0.064 \pm 0.038$ (GeV/c)$^{-2}$. Combining our data with those of two previous μ–p elastic scattering experiments yields $A^{-2} = +0.051 \pm 0.024$ (GeV/c)$^{-2}$ which is a much weaker limit on muon–electron universality than that obtained from μ–p inelastic scattering. (auth)

10986 BARYON-CONSERVATION LIMIT. Reines, F. (Department of Physics, University of California, Irvine, California 92664); Crouch, M.F. Phys. Rev. Lett. 32: No. 9, 493-494 (4 Mar 1974).

An improved lower limit of $> 2 \times 10^{30}$ yr against baryon-conservation-violating nucleon decay has been obtained for modes which produce $\mu \rightarrow e$ decays. The detector, employing a 20-ton large-area (180 m^2) liquid scintillator, was operated deep underground (3.2 km) to eliminate stopping muons from cosmic rays, leaving only the background from muons produced by atmospheric neutrinos. A run length of 2.7 yr was required to achieve the sensitivity quoted. (auth)

Strong (Baryon-induced)

Refer also to abstracts 9628, 10567, 11040, 11152, and 11578.

10987 (CONF-720737–, pp 203-253) BUBBLE CHAMBER EXPERIMENTS FOR STRONG INTERACTION STUDIES. Takahashi, K. (National Lab. for High Energy Physics, Ibaraki, Japan). Dec 1972.

From Proceedings of the 1972 KEK summer school; Ibaraki, Japan (17 Jul 1972).

The discussion of strong interaction studies using a bubble chamber includes what can be seen on bubble chamber films and what can be learned about strong interaction physics from events seen on the hydrogen bubble chamber films. The scanning and measuring of films are also described. (JFP)

10988 (COO-1428-332(Rev.)) p-p AND p-d ELASTIC AND INELASTIC SCATTERING IN THE NEW CO INTERNAL TARGET LABORATORY. Loeffler, F. (Purdue Univ., Lafayette, Ind. (USA)). 7 Feb 1974. Contract AT(11-1)-1428. 29p. Dep. NTIS $4.50.

An experiment is proposed to measure p-p and p-d elastic and inelastic scattering in the new CO Internal Target Area. These measurements will cover the t-region from 0.2 up to 10 (GeV/c)^2 for p-p elastic scattering and up to 5 (GeV/c)^2 for p-d elastic scattering. Incident beam energies from 8 to 500 GeV will be continuously covered. A magnetic spectrometer will be used to measure the angles and momenta of rhe recoil particles. In the higher t-region a forward hodoscope (or a forward magnetic spectrometer in later stages of the experiment) will be used to identify elastic from inelastic events. For absolute normalization solid state detectors will be installed which will cover both the Coulomb and nuclear scattering regions. (auth)

10989 (COO-3072-14) NEUTRON PROTON CHARGE EXCHANGE SCATTERING FROM 8 TO 29 GeV/c. Technical Report No. 4. Davis, M. B. (Princeton Univ., N. J. (USA). Elementary Particles Lab.). Sep 1972. Contract AT(11-1)-3072. 138p. Dep. NTIS $10.00.

Thesis.

The differential cross sections for neutron proton charge exchange scattering were measured for incident neutron momenta between 8 and 29 GeV/c and for four-momentum transfers $|t|$ between 0.002 and 1.0 (GeV/c)^2. A neutron beam with a broad momentum spectrum was scattered from a liquid hydrogen target. The momenta and scattering angles of the forward-scattered protons were measured by a spark-chamber magnet spectrometer. The times of flight and scattering angles of the recoil neutrons were measured by a bank of thick scintillation counters. The efficiencies of the neutron counters were determined in a separate measurement. Absolute normalization of the data was obtained from a measurement of the diffraction dissociation of neutrons from carbon nuclei. Differential cross sections, based on ~23,000 events, are presented for 9 different momenta. The shape of the differential cross sections and the momentum dependence are examined in detail. (auth)

10990 (IFA-HE-85-1974) ENERGY DEPENDENCE OF CHARGED MULTIPLICITY IN PROTON–NUCLEUS COLLISION AND "NUCLEAR" MULTIPLICITY SCALING. Friedlaender, E. M.; Marcu, M.; Nitu, R. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 9p. Dep. NTIS (US Sales Only) $4.00.

Proton reactions with emulsion nuclei at 69 GeV are studied. The main result found is that the ratio of the mean multiplicities of fast charged particles produced on a nuclear target does not depend on either the size or the degree of excitation or breakup of the target nucleus. Also these values are indistinguishable from those for p + p collisions. This result implies a specific nuclear multiplicity scaling. (JFP)

10991 (IFA-HE-86-1974) EVIDENCE FOR "NUCLEAR MULTIPLICITY SCALING" ABOVE 200 GeV. Friedlaender, E. M.; Marin, A. A. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 9p. Dep. NTIS (US Sales Only) $4.00.

Incoherent nuclear meson production was studied in proton interactions with complex nuclei. It was found that nuclear multiplicity scaling is seen to hold in good approximation at least from 0.1 to 10 TeV and at multiplicities ranging from 10 to 200 mesons per proton–nucleus collision. (JFP)

10992 (IFA-HE-87-1974) UNEXPECTED APPARENT TRANSPARENCE OF NUCLEAR MATTER FOR HIGH-ENERGY HADRONS, OBSERVED IN p–NUCLEUS COLLISION AT 200 GeV. Cohen, J. I.; Friedlaender, E. M.; Marcu, M.; Marin, A. A.; Nitu, R. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 8p. Dep. NTIS (US Sales Only) $4.00.

Some regularities of the angular distribution of fast secondaries from collisions of 200-GeV protons in nuclear emulsions are pointed out. (JFP)

10993 (IFVE-SEF-73-28) INVESTIGATION OF $\bar{p}p \rightarrow \bar{n}n$ CHARGE-EXCHANGE REACTION IN 20 TO 40 GeV/c MOMENTUM RANGE. Babaev, Z. R.; Bolotov, V. N.; Vasil'ev, L. M.; Isakov, V. V.; Kakauridze, D. B.; Karpekov, Yu. D.; Postoev, V. E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 20p. (In Russian). INIS.

The possibility of investigating the $\bar{p}p \rightarrow \bar{n}n$ process over a wide interval of momenta of the antiprotons is considered. At lower energies the behavior of the differential cross sections of this reaction cannot be placed within the framework of existing theoretical representations. In carrying out the measurements it is proposed that a modified variant of establishing channel 4A be used. It is suggested that the events of the antiproton charge transfer be isolated by counting the nuclear interactions of antiprotons with matter in the spark spectrometer. Estimates of the contributions of phonon processes will be derived on the basis of an analysis of a similar (in the sense of counting) reaction $K^-p \rightarrow K^0_{L,S}n$, which can be isolated in two ways: from the nuclear interactions of K^0_L with matter, and from the kinematically isolated decays $K^0_S \rightarrow \pi^+\pi^-$. (SJR)

10994 (JINR-D1-2-7411) INTERNATIONAL SEMINAR ON DEEP INELASTIC AND MANY-BODY PROCESSES AT HIGH ENERGIES, DUBNA, USSR, JUNE 7–13, 1973. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1973. 501p. (In Russian and English). (CONF-730680-).

The collection contains 32 review talks submitted to the International Seminar on Deep Inelastic and Many-Body Processes at High Energies (Dubna, June 7–13, 1973). The contents of the reviews are devoted to the processes of multiple particle production in hadron and electromagnetic interactions intensively investigated at present at giant accelerators in the USSR and abroad. (auth)

10995 (JINR-E1-7876) ANALYSIS OF TOPOLOGICAL CROSS SECTIONS IN ANTI PP INTERACTIONS AT 22.4 GeV/c. Abesalashvili, L. N.; Amaglobeli, N. S.; Boguslavskii, I. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

The multiplicity distribution for 11558 events in $\bar{p}p$ interactions at 22.4 GeV/c was analyzed. The average charged multiplicity $\langle n_{ch} \rangle$ for inelastic events was found to be 4.69 ± 0.05 and $\langle n_{ch} \rangle / D = 2.04 \pm 0.05$. The early KNO scaling of normalized topological cross sections was tested. (auth)

10996 (JINR-P6-7408) DYNAMIC POLARIZATION OF PROTONS IN POLYETHYLENE AT SUPERLOW TEMPERATURES. Borisov, N. S.; Bunyatova, E. I.; Kiselev, Yu. F.; Neganov, B. S.; Parfenov, L. B.; Rosantsev, E. G.; Stryukov, V. B.; Feller, G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 10p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The spin polarization of protons 50% was achieved at the temperature of 0.1°K in the magnetic field of 27 ke in polyethylene of low density containing a stable radical-tetramethylpiperidin-1-oxyl. The possibility is mentioned of creation of a "frozen" polarized proton target in a small magnetic field at the temperature of 0.05°K. (auth)

10997 (NAL-CONF-73-25-EXP) pp INTERACTIONS AT 205 GeV/c. Barish, S.; Cho, Y.; Colley, D. (National Accelerator Lab., Batavia, Ill. (USA)). Jun 1973. 22p. (CONF-730320-4). Dep. NTIS $4.50.

From conference on high energy particle interactions; Nashville, Tennessee, USA (26 Mar 1973).

Preliminary results are presented on 205 GeV/c pp interactions in the 30-inch hydrogen bubble chamber. The single particle inclusive distributions are compared to other NAL data, ISR data, and data from lower energies. Data on charged particle correlations and the preliminary results of a study of the diffractive process are also discussed. (auth)

10998 (NAL-CONF-73-67-THY-EXP) REVIEW OF LARGE TRANSVERSE MOMENTUM PHENOMENA IN HADRON COLLISIONS. Walker, J. K. (National Accelerator Lab., Batavia, Ill. (USA)). Sep 1973. 15p. (CONF-730841-3). Dep. NTIS $4.00.

From 5th international conference on high energy collisions; Stony Brook, New York, USA (23 Aug 1973).

Recent experimental data from NAL and the ISR on large transverse momentum single particle production in proton proton collisions are reviewed. The approach to energy scaling, particle ratios, and associated multiplicities, etc. is discussed. (auth)

10999 (NAL-CONF-73-68-EXP) DIFFRACTION DISSOCIATION IN pp INTERACTIONS AT NAL. Whitmore, J. (National Accelerator Lab., Batavia, Ill. (USA)). Sep 1973. 5p. (CONF-730837-13). Dep. NTIS $4.00.

From meeting of the division of particles and fields; Berkeley, California, USA (13 Aug 1973).

A brief summary of the study of diffractive fragmentation in pp collisions as observed in the NAL bubble-chamber experiments is presented. Missing mass, effective mass, and secondary particle rapidity distributions permit a) the study of the multiplicity and t dependences of the diffractive process at high energy b) the measurement of the cross section for the reaction $pp \to pp\pi^+\pi^-$, and c) an estimate of an upper limit for the double Pomeron exchange contribution to the $pp\pi^+\pi^-$ final state at 205 GeV/c. (auth)

11000 SEARCH FOR FRACTIONALLY CHARGED QUARKS PRODUCED BY 200- AND 300-GeV PROTON-NUCLEAR INTERACTIONS. Nash, T.; Yamanouchi, T. (National Accelerator Laboratory, Batavia, Illinois 60510); Nease, D.; Sculli, J. Phys. Rev. Lett. 32: No. 15, 858-862 (15 Apr 1974).

We describe an experimental search for particles with fractional charge (quarks) with mass below 11 GeV/c^2 produced by proton-nucleus collisions at 200 and 300 GeV. No evidence for such particles was found. Limits on the quark production cross section are given. (auth)

11001 SEARCH FOR AND STUDY OF MULTIBARYON RESONANCES HAVING ZERO AND NONZERO STRANGENESS. Shakhbazyan, B. A. (Joint Institute for Nuclear Research, Dubna). Sov. J. Particles Nucl.; 4: No. 3, 332-349(Jan 1974).

A review is given of experimental studies of the search and investigation of multibaryonic resonances performed by means of various experimental methods during the last ten years. Some problems arising due to the possibility of the existence of such resonances are discussed. (auth)

11002 FOUR-PION FINAL STATE IN $\bar{p}p$ ANNIHILATIONS AT 0.7 TO 1.1 GeV/c. Burns, R. R.; Condon, P. E.; Donahue, J.; Mandelkern, M. A.; Schultz, J. (Univ. of California, Irvine). Nucl. Phys., B73; No. 2, 219-230(1974).

Results are reported on the reaction $\bar{p}p \to \pi^+\pi^+\pi^-\pi^-$ at six lab momenta spanning the region from 0.686 to 1.098 GeV/c. The cross section for this process drops from 5.2 ± 0.4 mb at 0.686 GeV/c to 2.9 ± 0.2 mb at 1.098 GeV/c. Resonance production is determined by means of a model which includes Bose symmetrization and Breit-Wigner amplitudes. The likelihood fit to the resonance channels yields a few per cent $\rho\pi\pi$, approximately 10% in each of the channels $f\pi\pi$, $\rho\rho$, and $A_2\pi$, and about 40% ρf production, with errors on the order of 5%. Excellent fits to the mass distributions are obtained. Essentially all production and decay angular distributions are found to be uniform, with only a few small deviations from isotropy reported. The angular correlations between like and unlike charged pion pairs are also found to be fit extremely well by the simple model of resonance production with Bose symmetrization. (auth)

11003 TOTAL PROTON-PROTON CROSS-SECTION AT THE ISR. Bellettini, G. (Univ., Pisa, Italy). pp 35-63 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The recent ISR data on total proton-proton cross sections for center-of-mass energy between 23 and 53 GeV are reviewed from an experimentalist's point of view. (auth)

11004 SMALL ANGLE PROTON SCATTERING AT NAL AND AN EMERGING PICTURE OF HIGH ENERGY PROCESSES. Carrigan, R. A. (National Accelerator Lab., Batavia, IL). pp 79-90 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

Preliminary small angle proton-proton scattering results from NAL are reviewed and related to other high energy results on total cross sections, the forward real part and moderate |t| scattering. It is suggested that each effect undergoes a behavior transition somewhere in the energy range from 100 to 200 GeV. (auth)

11005 PROTON-PROTON ELASTIC SCATTERING AT ISR ENERGIES. Strolin, P. (CERN, Geneva). pp 65-77 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The experimental results obtained on proton-proton elastic scattering at the CERN Intersecting Storage Rings are reviewed, with special consideration to the most recent results on large angle scattering. (auth)

11006 PHENOMENOLOGY OF PROTON-PROTON SCATTERING AT ALL ANGLES. Coon, D. D. (Univ. of Pittsburgh). pp 267-280 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

Fits were made to the proton-proton differential cross section and the difference of the proton-antiproton and proton-proton total cross sections using a dual model of Baker and Coon. These fits tend to indicate that: there is a fairly simple dominant contribution to large momentum transfer processes, the range of applicability of duality and Reggeism is much larger than one might expect, the Baker-Coon model has an enormous range of quantitative validity, the Pomeron contribution to the pp differential cross section can be separated from the dual contribution and the Pomeron contribution so extracted has a sharp diffraction minimum at the shoulder at $t = -1.2(GeV)^2$. The mechanism for producing the shoulder survives the test of an extrapolation from $s = 20(GeV)^2$ to $s = 2600(GeV)^2$ and predicts the depth of the dip at $t = -1.2$ $(GeV)^2$ in the ISR data. The Pomeron contribution at conventional accelerator energies is very well approximated by an eikonalized Pomeron exchange term. (auth)

11007 HIGH ENERGY EXPERIMENTS. Minten, A. (CERN, Geneva). pp 1-20 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer institute on theoretical physics meeting; Kaiserslautern, F. R. Germany (17 Jul 1972). See CONF-720738-.

A lecture is given on the experimental progress observed during the last year at high energy accelerators. Particle production in inclusive reactions, elastic scattering, and total cross sections at high and very high energies up to 2000 GeV are covered. (JFP)

11008 MEASUREMENT OF THE RATIO $G_E G_M$ OF THE PROTON FORM FACTORS AT VERY LOW MOMENTUM TRANSFER. Theissen, H.; Schuetz, W. (Technische Univ., Darmstadt, Ger.). Z. Phys.; 266: No. 1, 33-36(1974).

The ratio $\mu G_E G_M$ of the proton form factors was determined by measuring the electron scattering cross section of the proton relative to that of ^{12}C. Data taken at $q^2 = 0.09$, 0.16, 0.25, and 0.36 fm^{-2}, yielding a weighted mean of $\mu G_E G_M = 1.01 \pm 0.03$. (GE)

11009 MNOZHESTVENNAYA GENERATSIYA CHASTITS. (Multiple Generation of Particles). Zhdanov, G. B. Moscow; Izdatel'stvo Nauka (1974). 168p.

New astrophysical discoveries have shown worlds of superhigh temperatures and pressures. Under these conditions particles of

atomic nuclei—nucleons—can be accelerated up to energies equivalent to the heating of matter to a trillion degrees. During the collision of such particles unimaginable high energies are concentrated which leads to simultaneous birth or generation of a multiplicity of new particles—mesons, excited nucleons, and antiparticles. Methods for the experimental study of processes of multiple generation of particles by means of cosmic rays and powerful charged particle accelerators are examined and described in this book. (tr-auth)

11010 LEPTON AND HADRON MAGNETIC DIPOLE MOMENTS. Frauenfelder, H. (Univ. of Illinois, Urbana). J. Phys. Soc. Jap., Suppl.; 34: 291-301(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The magnetic dipole moment has often served as an "advance indicator" for major new features emerging in subatomic physics. Some of the fundamental discoveries based on magnetic dipole moment measurements are discussed. The techniques used for the determination of the g factors of leptons and hadrons (particles and nuclei) possess many similarities. The various methods are sketched, with emphasis placed on the common features. (4 figures) (auth)

11011 MOMENTUM SPECTRA OF NUCLEAR ACTIVE PARTICLES IN THE COSMIC RADIATION AT SEA LEVELS. I. Experimental Data. Diggory, I. S.; Hook, J. R.; Jenkins, I. A.; Turver, K. E. (Univ. of Durham, Eng.). J. Phys., A (London); 7: No. 6, 741-764(11 Apr 1974).

A cosmic ray spectrograph was used to measure the momentum spectra of cosmic ray protons and pions in the momentum range 1 to 30 GeV/c in the near vertical direction at sea level. The observed intensities of both protons and pions are greater than those obtained in previous measurements (Brooke and Wolfendale. Proc. Phys. Soc.; 83: 871-7 (1964)). (auth)

11012 PION PRODUCTION IN 5-GeV/c PERIPHERAL ANTIPROTON-EMULSION INTERACTIONS. Bhowmik, B.; Singh, S. (Department of Physics and Astrophysics, University of Delhi, Delhi, India). Phys. Rev. D 9: No. 1, 63-76 (1 Jan 1974).

The aim of the present work is to investigate the role of resonances in multiple-pion production in the annihilation and nonannihilation interactions of 5-GeV/c antiprotons with the free or quasifree nucleons of emulsion nuclei. The separation of these interactions has been made on the basis of a plot of median angle against impact parameter for individual events. A phenomenological investigation of the following aspects has been made: the average survival probability, multiplicity, inelasticity, azimuthal and c.m. angular distributions, total and longitudinal momenta in the c.m. system, and transverse momentum and its dependence on multiplicity, c.m. angle, and longitudinal momentum. It has been observed that the features of nonannihilation interactions are similar to those of p-N interactions at comparable primary energies. It has also been inferred that N* (1238) and N* (1238) are responsible for the production of almost all the pions in nonannihilation events. In the annihilation interactions, dominant production of ρ- and ω-meson resonances has been observed. In the over-all annihilation channels, production of ρ seems to be much larger than that of ω and the former appears to be emitted preferentially in the forward and the latter in the backward direction of the c.m. system. (auth)

11013 $P\bar{P}$ ANNIHILATIONS INTO FOUR CHARGED MESONS FROM 1.6 TO 2.2 GeV/c. Davidson, J.; Chapman, J.W.; Green, R.W.; Lys, J.; Roe, B.P. (The University of Michigan, Ann Arbor, Michigan 48104). Phys. Rev. D 9: No. 1, 77-90 (1 Jan 1974).

The following reactions have been analyzed: (1) $\bar{p}p \to \pi^-\pi^-\pi^+\pi^+$; (2) $\bar{p}p \to \pi^-\pi^+K^-K^+$; (3) $\bar{p}p \to K^-K^-K^+K^+$. Cross sections as a function of beam momentum ranging from 1.6 to 2.2 GeV/c are presented. The percentage of resonance production in reaction (1) is examined using the maximum-likelihood (ML) method. The channel is dominated by $\rho\pi\pi$ and pf production. The percentage of pf decreases with $\bar{p}$ momentum, while $\rho\pi\pi$ appears to increase. ML fits are also made to reaction (2); the reaction is dominated by $K^*K\pi$, $\phi\pi\pi$, and ρKK production. An enhancement is seen in the Q region of the $\pi\pi K$ mass spectrum at 1278 MeV, with FWHM (full width at half-maximum) of 25 MeV. Six events are consistent with reaction (3). Mass spectra indicate that five events have at least one φ meson produced; one of these is a φφ event. (auth)

11014 RESONANCE PRODUCTION IN $\bar{P}$ $P \to \pi^+\pi^+\pi^-\pi^-K^+K^0$ AT 1.6 TO 2.2 GeV/c. Green, R.W.; Chapman, J.W.; Davidson, J.; Lys, J.; Roe, B.P. (The University of Michigan, Ann Arbor, Michigan 48104). Phys. Rev. D 9: No. 1, 90-106 (1 Jan 1974).

The reaction $\bar{p}p \to \pi^+\pi^+\pi^-\pi^-\pi^0$ has been studied at six incident antiproton momenta (1.63, 1.77, 1.83, 1.88, 1.95, and 2.20 GeV/c). The data were taken from 150 000-picture exposure in the MURA-ANL hydrogen bubble chamber. After examining amibiguities with other final states, a low contamination sample of 12357 events was obtained. Cross sections were determined at each energy. The properties of ρ^0, $\rho^\pm$, ω^0, and η^0 mesons produced in this reaction are discussed; evidence for production of the B meson is presented. The A_2, f, and g mesons are seen, but are not examined in detail. The cross sections of resonance channels are examined using the maximum-likelihood method, with a likelihood function based on Breit-Wigner amplitudes and meson-decay matrix elements. Particular attention is payed to the stability of the results as the detailed form of the fitting functions is varied. The reaction is dominated by the production of the ρ^0, $\rho^\pm$, and ω^0 mesons, with cross sections of about 50%, 50%, and 20% of the five-pion cross section, respectively. The largest channel is found to be $\rho^0\rho^\pm\pi^\mp$, accounting for over one third of the five-pion events. Cross sections of all resonance channels are examined as a function of energy. The resonance-channel cross sections are compared to the cross sections determined in experiments at other energies. Qualitative features are found to be consistent between experiments. The cross sections show fluctuations between experiments which are larger than statistically expected. (auth)

11015 PROTON–NUCLEUS INTERACTIONS AT 200 GeV/c. Alma-Ata-Leningrad-Moscow-Tashkent Collaboration. Yadern. Fiz.; 19: No. 5, 1046-1052(May 1974). (In Russian).

The main properties of the proton–nucleus interactions at 200 GeV/c are investigated in the photoemulsion. Multiplicity distributions of relativistic particles (n_s) and slow particles (N_b) are obtained on basis of the total statistics of 3255 events observed in track scanning. It is found that $\langle n_s \rangle = 13.8 \pm 0.2$ and $\langle N_b \rangle = 7.3 \pm 0.1$, while $\langle N_b \rangle$ and the N_b distribution are close to those obtained at lower energies. Part of the statistics (631 stars) provides for angular distributions of the relativistic secondary particles and their dependence on n_s. Comparing the p-nucleus and pp interactions it is evident that up to $n_s \sim 16$ the angular characteristics are identical; for $n_s \geq 17$ a considerable broadening of the distributions toward large angles is observed. Data on multiplicities of the relativistic particles are also presented for various rapidity regions (fragmentation and pionization regions) for the p-nucleus and pp interactions at various n_s. It is found that the multiplicity of the relativistic particles in the fragmentation region of the incident nucleon, in the p-nucleus and pp pionization regions are close to each other, while the multiplicities are essentially different in the target fragmentation regions. (auth)

Strong (Meson-induced)

Refer also to abstract 11209.

11016 (CEA-N-1682) STUDY OF K^- REACTIONS ON NEUTRONS BETWEEN 1640 AND 1880 MeV USING A DEUTERIUM BUBBLE CHAMBER. Pierre, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Jan 1974. 124p. (In French). Dep. NTIS (US Sales Only) $9.25.

Thesis.

Inelastic K^- reactions on neutrons were investigated in order to study the formation of isospin 1 resonances. A statistical frequency of 1.2 events per μ barn was used in the experiments performed. The cross sections corresponding to two and three body reactions were determined together with those of quasi-two body reactions. These cross sections were subsequently used to deduce the branching ratios of Σ resonances; the results of K^-p reactions were used to investigate Λ resonances. Particular attention is given to analyzing anti $KN \to \Sigma\eta$ reactions, the threshold of which appears to be dominated by $\frac{1}{2}^-$ spin-parity. (auth)

11017 (IFA-HE-88-1974) COMPARISON OF MULTIPLICITIES IN PION–NUCLEUS AND PROTON–NUCLEUS INTERACTIONS AROUND 60 Gev. Bogdan, B.; Cincheza, I.; Cohen, J.; Friedlaender, E. M.; Haiduc, M.; Marcu, M.; Visky, T. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 7p. Dep. NTIS (US Sales Only) $4.00.

Results on π^--nucleus collisions in nuclear emulsions, obtained under very similar conditions to those in proton experiments, which show that the same scaling law holds also for pion collisions in this energy region are presented. However, an unexpected difference in the complexity of the interaction of fast pions with emulsion nuclei with respect to proton interactions is observed. The incident pion beams were at 45 and 60 GeV/c. (JFP)

11018 (IFVE-SEF-73-2) MEASURING CROSS-SECTION $K^-p \to K^0n$ REACTION AT 25 GeV/c MOMENTUM. Belousov, V. I.; Dmitrievskii, Yu. P.; Karpenkov, Yu. D. (Gosudarstvenny) Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 10p. (In Russian). INIS.

Results are presented for measuring the cross section of the charge-transfer reaction $K^-p \to K^0n$ at 25 GeV/c momentum.

The set of reactions were identified by exact measurement of the angle of decomposition of $K^0_S \rightarrow \pi^+\pi^-$. (SJR)

11019 (IFVE-SEF-73-47) MEASUREMENT OF THE POLARIZATION PARAMETER IN π^-p ELASTIC SCATTERING AT 40 GeV/c. Bruneton, K.; Bystritski, I.; Derezhel, Z. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 10p. (In Russian). INIS.

This study presents the first results on the polarization of π^--mesons in elastic scattering on polarized protons at an incident particle momentum of 40 GeV/c. Measurements were carried out in the interval of transmitted momenta $0.08 < |t| < 1.3$ $(GeV/c)^2$. The energy dependence of the first minimum near $t = -0.2$ can be expressed in simple form: $-(0.48 \pm 0.06)$. S^- (0.52 ± 0.05). (SJR)

11020 (JINR-E2-7733) NUCLEON ISOSPIN-POLARIZATION AND ISOSPIN BOUNDS IN PION-NUCLEON SCATTERING. Ion, D. B.; Mihul, A. C. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 35p. Dep. NTIS (US Sales Only) $4.75.

The nucleon isospin-polarization parameter and its isospin bounds are determined from the experimental data of π^+p -elastic and charge exchange reactions. The saturation of the isospin bounds is explained in terms of the resonance poles and zeros of the isospin exchange amplitudes in the s, t, u -channels. (auth)

11021 (JINR-P1-7840) MEASUREMENT OF THE $\pi^-p \rightarrow \pi^0\pi^0n$ REACTION CROSS SECTION AT 276 MeV. Kravtsov, A. V.; Kuptsov, A. V.; Nemenov, L. L.; Starchenko, E. A.; Khazins, D. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Using the equipment including the total absorption Čerenkov spectrometers, scintillation and Cerenkov counters, the processes of π^-p interaction at 276 MeV, producing two or more photons at final state where detected. The analysis of the obtained data allows one to determine the cross section $\sigma(\pi^-p \rightarrow \pi^0\pi^0n) = (0.27 \pm 0.07)$ mb. (auth)

11022 (ORO-2504-191) MEASUREMENT OF THE CROSS SECTION FOR $\pi^+p \rightarrow \pi^+\pi^+n$ NEAR THRESHOLD. Technical Report No. 73-040. Crouch, J. H. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Feb 1974. 150p. Dep. NTIS $10.50.

Thesis.

An experiment to measure the cross section for the reaction $\pi^+p \rightarrow \pi^+\pi^+n$ at an incident pion kinetic energy of 195 MeV or 23 MeV above the threshold is described. The cross section is expected to be a few microbarn at 195 MeV. The experiment was performed in a high intensity π^+ beam built at the N.A.S.A. Space Radiation Effects Laboratory. The apparatus included a large digitized neutron detector array, four streamer chambers, numerous scintillation counters, and a hydrogen gas target. Data were collected for each event-trigger simultaneously on film and magnetic tape and were later analyzed to identify $\pi^+p \rightarrow \pi^+\pi^+n$ events. The analysis produced a sample of 13 ± 9 events and an unidentified background of ~30 events. This resulted in a cross section of (6.3 ± 4.3) μb which is consistent with the prediction of the $\pi\pi$ theory of Schwinger, but does not exclude that of Weinberg. (auth)

11023 (ORO-2504-214) K^+p INTERACTION AT 473 MeV/c AND 590 MeV/c. Technical Report No. 74-70. Fram, J. R. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Dec 1973. 118p. Dep. NTIS $9.00.

Thesis.

The K^+p interaction was investigated at 473 and 590 MeV/c by means of a bubble chamber experiment. On the basis of a sample of about 3000 events at 473 MeV/c and 3700 events at 590 MeV/c, the elastic cross sections were found to be $12.5 \pm .6$ and $12.7 \pm .6$ mb, respectively. The angular distribution of the elastic scatters at both momenta was consistent with a pure s-wave amplitude, and the s-wave phase shift was found to be unambiguously negative from Coulomb interference. The total inelastic cross section measured at 590 MeV/c was $11.2^{+1.1}_{-1.3}$ μb. (auth)

11024 STRUCTURE IN THE $\omega\pi\pi$ SYSTEM AT THE A_2 MASS REGION. Karshon, U.; Mickenberg, G.; Pitluck, S.; Eisenberg, Y.; Ronat, E.E.; Shapira, A.; Yekutieli, G.; Weizmann Institute of Science, D.o.N.P. Rehovot,Israel. Phys. Rev. Lett. 32: No. 15, 852-854 (15 Apr 1974).

Evidence is presented for an enhancement in the $\omega\pi\pi$ mass spectrum at the A_2 mass region in π^+p interactions at 5 GeV/c. Assuming this effect to be the A_2, we calculate the decay rate relative to the $p\pi$ decay mode and obtain the results 0.29 ± 0.08 and 0.10 ± 0.04 for the two final states $A_2^0\Delta^{++}$ and A_2^+p, respectively. Possible explanations of the discrepancy between these numbers are suggested. (auth)

11025 OBSERVATION OF ωp ENHANCEMENT FROM THE REACTION $\pi^-p \rightarrow \pi^-\omega p$ AT 4.5, 6, AND 14 GeV/c. Davidson, V.; Dzierba, A.; Firestone, A.; Ford, W.; Gomez, R.; Nagy, F.; Peck, C.; Rosenfeld, C.; Sheng, A. (California Institute of Technology, Pasadena, California 91109); Gordon, H.A.; Habibi, M.; Stumer, I.; Ely, R.; Grether, D.; Oddone, P.; Lai, K. Phys. Rev. Lett. 32: No. 15, 855-858 (15 Apr 1974).

An enhancement near the ωp threshold has been observed with a mass of 1820 MeV and a width of about 120 MeV from the reaction $\pi^-p \rightarrow \pi^-\omega p$ at 4.5, 6, and 14 GeV/c. There is no strong evidence for π N or ρN decay modes. We examine spin and parity and production characteristics. (auth)

11026 INTERACTIONS $K^+d \rightarrow K^+d$, $K^+d \rightarrow K^+pn$, $K^+d \rightarrow K^0pp$ AT 3 GeV/c. Dufour, P. Mol, Belgium; Centre d'Etude de l'Energie Nucleaire (1973). 180p. (In French).

Thesis.

At the beginning of this $K^+ + d$ experiment at 3 GeV/c in 1968, the $K^+ + d$ interactions had only been studied up to a maximum momentum of 2.3 GeV/c. An investigation is made of a lot of 90,000 pictures coming from the Saclay 81-cm bubble chamber exposure to a K^+ meson beam from the CERN proton synchrotron. The following interactions are studied: elastic scattering $K^+ + d \rightarrow K^+ + d$ 902 events, $K^+ + d \rightarrow K^+ + p + n$ 3055 events, and the charge exchange reaction $K^+ + d \rightarrow K^0 + 2p$ 214 events. The charge-exchange reaction has been made the object of numerous theoretical predictions in particular in the frame of the Regge pole model and in that of SU(3). Moreover the interest presented by elastic scattering being such, the first and second reactions allow the best investigation of $K^+ + \lambda$ elastic scattering. Up to the present these two reactions have not been studied. In fact, although the events which arise having two charged particles in the final state, their dynamics is such that in a large number of cases a single particle can be observed in the bubble chamber. (tr-auth)

11027 ELASTIC SCATTERING OF π^+ AND K^+ MESONS ON PROTONS AT 10 GeV. Baglin, C. (CERN, Geneva). pp 247-265 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The angular distributions of π^+p and K^+p elastic scattering were measured at an incident momentum of 10 GeV. Nearly the whole angular range was covered in one experimental set up. A dip is again observed in π^+p at $-t = 2.8$ GeV^2. No structure is observed in K^+p in either the forward direction up to $-t = 2$ GeV^2 or in the backward direction up to $-u = 2$ GeV^2. In the 90 deg c.m. region the differential cross section is approximately 2nb/GeV^2 for both reactions. Results from other experiments above 10 GeV are summarized. Some theoretical explanations are sketched for the observed (or not observed) forward peak structures, and for the energy behavior of the large angle region. (auth)

11028 REVIEW ON SCATTERING-AMPLITUDE ANALYSIS. Yokosawa, A. (Argonne National Lab., IL). pp 435-449 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

Attempts to determine πN scattering amplitudes at around 6 GeV/c were made since results of several scattering measurements with polarized-proton targets became available. New πp charge-exchange polarization data are compared with various theoretical models and πN amplitude analyses are reviewed. (auth)

11029 FOUR-PRONG EVENTS IN π^-p interactions at 5 GeV/c. Boettcher, H. (Institut fuer Hochenergiephysik, Berlin); Nowak, W. D.; Constantinescu, A.; Teleman, M. Glagolev, V. V.; Emelianenko, V. N. Rev. Roum. Phys.; 19: No. 1, 81-100(1974).

The cross sections of the reaction channels and those of resonance production in four-prong πp interactions at 5 GeV/c are determined. The events are distributed over the Van Hove sectors; the results are compared with the Van Hove analysis at higher energies. (auth)

11030 COMPARISON OF MEDIUM ENERGY DATA WITH ISR RESULTS. Stroynowski, R. (CERN, Geneva). pp 583-605 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

ISR data are compared with the data from bubble chamber π^+p experiments at 8.16 and 23 GeV/c. The first topic concerns the forward peak observed in the reaction $pp \rightarrow p +$ anything; the question is whether there is scaling when events coming from diffraction dissociation only are selected using the reaction $\pi^+p \rightarrow \pi^+ +$ anything at 8.16 and 23 GeV/c. The second topic

concerns recent results from the ISR on transverse momentum distribution. (auth)

11031 PERIPHERAL $p\bar{p}$ PRODUCTION AND DECAY ANGULAR DISTRIBUTION IN THE REACTION $\pi^- p \rightarrow p\bar{p}n$ AT 18.8 AND 9.8 GeV. Hyams, B. (CERN, Geneva); Jones, C.; Weilhammer, P.; Blum, W.; Dietl, H.; Grayer, G.; Koch, W.; Lorenz, E.; Luetjens, G.; Maenner, W.; Meissburger, J.; Stierlin, U. Nucl. Phys.; B73: No. 2, 202-218(1974).

A total of 13920 $\pi^- p \rightarrow p\bar{p}n$ events measured in a spark chamber experiment at 9.8 GeV incident π^- momentum are compared with our data recently published on the same reaction at 18.8 GeV. The s-dependence of the total cross section, the shape of $d^2\sigma/dMdt$, and the $p\bar{p}$ decay angular distributions at both energies suggest that the production process is dominated by one-pion exchange. This is supported by comparison with new $\pi^+ p \rightarrow p\bar{p}p$ and $p\bar{p} \rightarrow \pi^+\pi^-$ annihilation data. An interpretation of the angular distribution by partial waves is discussed, and results from a fit with a Breit–Wigner parametrization are presented. The cross section for the reaction $\pi^- p \rightarrow p\bar{p}n$ in the range $M_{p\bar{p}} \leq 2.7$ GeV and $|t_{np}| \leq 0.3$ GeV^2 has been determined to be $\sigma = 6.5 \pm 0.9$ μb at 9.8 GeV. (auth)

11032 SEARCH FOR THE EXISTENCE OF DELTA$^-$-MESON IN $\pi^- p \rightarrow$ DELTA$^-$p NUCLEAR INTERACTION. Upadhyay, P. N. (Gaya Coll., India). Indian J. Pure Appl. Phys.; No. 11, 856-858 (Nov 1973).

In a missing mass counter experiment, a study of the interaction $\pi^- p \rightarrow \delta^- p$ just above the production threshold has indicated an enhancement near a mass of 990 MeV/c^2. The observations were made over the range -0.38 to -0.79 GeV/c^2 of the four-momentum transfer-squared parameter (t). The missing mass of the δ^--meson was calculated by measuring the incident pion momentum and the proton time-of-flight. (auth)

11033 SEARCH FOR THE DELTA$^-$-MESON IN THE NUCLEAR INTERACTION $P\bar{I}p \rightarrow$ DELTA$^-$p. Upadhyay, P. N. (Gaya Coll., India). Indian J. Pure Appl. Phys.; No. 11, 802-804 (Nov 1973).

Evidence is presented for the existence of an I-1 resonance at a mass 996 ± 12 MeV/c^2 and width $\Gamma = 40^{+40}_{-8}$ MeV/c^2 produced in the interaction: $\pi^- p \rightarrow \delta^- p$ with $\delta^- \rightarrow \eta\pi^-$ and $\eta \rightarrow \gamma\gamma$. (auth)

11034 STUDY OF $K^+ p \rightarrow K^0\Delta^{++}(1236)$, $K^- p \rightarrow \bar{K}^0 n$, AND $K^- p \rightarrow \bar{K}^0\Delta^0(1236)$. Foley, K.J.; Love, W.A.; Ozaki, S.; Platner, E.D.; Saulys, A.C.; Willen, E.H. (Brookhaven National Laboratory, Upton, New York, 11973); Lindenbaum, S.J.; Kramer, M.A. Phys. Rev. D 9: No. 1, 42-48 (1 Jan 1974).

We have studied the reactions $K^+ p \rightarrow K^0\Delta^{++}(1236)$ at 15.7 GeV/c, $K^- p \rightarrow \bar{K}^0 n$ at 10.7 and 15.7 GeV/c, and $K^- p \rightarrow \bar{K}^0\Delta^0(1236)$ at 15.7 GeV/c in the BNL Double Vee Magnetic Spectrometer. The π^+ and π^- from the decays of forward K^0s were detected and the above reactions were identified by a missing-mass technique. Total and differential cross sections are presented for the first two reactions and a total cross section for the third. (auth)

11035 INVESTIGATION OF CORRELATIONS IN PARTICLE PRODUCTION IN πN INTERACTIONS AT p = 40 GeV/c. Alma-Ata-Moscow-Sofia-Tashkent-Tbilisi-Ulan-Bator-Khanol Collaboration. Yadern. Fiz.; 19: No. 5, 1039-1045(May 1974). (In Russian).

Results are presented on the study of some correlation effects in $\pi^- p$ interactions at the momentum of 40 GeV/c. Based on 2000 events, dependences of the π^+,π^--meson transverse momenta on the longitudinal components, two-particle distributions for various pion pairs and the correlation functions $C(y_1, y_2)$ and $R(y_1, y_2)$ are obtained. For the $(\pi^+\pi^-)$ pairs R(0, 0) = 0.65 ± 0.07 and the correlation length L = 1.8 ± 0.2 at $-1 \leq y_1, y_2 \leq 1$. For the $(\pi^+\pi^+)$ and $(\pi^-\pi^-)$ pairs R(0, 0) = 0.26 ± 0.1. Comparison of these results with data on pp interactions at the ISR energies and at 200 GeV indicates that the limiting distributions of two-particle spectra $R(y_1, y_2)$ in πN interactions occurs already at 40 GeV. (auth)

11036 $\pi\pi$-SCATTERING CROSS SECTION IN THE I = 2 STATE. Beketov, G. V.; Zombkovskii, S. M.; Kaidalov, A. B.; Konovalov, B. S.; Kruchinin, S. P.; Selector, Ya. M.; Turov, V. F.; Shulyachenko, V. N. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 19: No. 5, 1032-1038 (May 1974). (In Russian).

The 50- and 55-cm liquid hydrogen bubble chambers were used to study the reaction $\pi^- p \rightarrow \pi^-\pi^-\Delta^{++}$ (1236) at 4.45 and 4.6 GeV/c incident pion momenta. The S and D phases are obtained as well as the $\pi\pi$-scattering cross sections in the I = 2 state for seven intervals of the $\pi^-\pi^-$-system masses from 0.28 to 1.4 GeV. The $\pi\pi$ cross sections are determined taking into account the background calculated in the Regge pole exchange model. The results are compared with other data. (auth)

Particle Interactions and Properties (Theoretical)

11037 SOME TOPICS IN WEAK AND ELECTROMAGNETIC INTERACTIONS. Bjorken, J. D. (Stanford Linear Accelerator Center, Stanford, California). Sov. J. Particles Nucl.; 4: No. 3, 288-298(Jan 1974).

Some theoretical and experimental aspects of weak and electromagnetic interactions at high energies are studied. In the first part the foundations of weak and electromagnetic theory and the question of higher orders of the weak interaction are considered. In the second part the deep inelastic lepton-hadron interactions are considered, when not only a lepton is observed but also some hadrons. (auth)

General

Refer also to abstract 11742.

11038 (CONF-720737–, pp 163-202) TOPICS IN PARTICLE PHENOMENOLOGY. Moravcsik, M. J. (Univ. of Oregon, Eugene). Dec 1972.

From proceedings of the 1972 KEK summer school; Ibaraki, Japan (17 Jul 1972).

Some recent developments are reviewed concerning those aspects of particle reactions which are entirely or almost entirely independent of dynamical models. The spin structure of particle reactions, the application of conformal mapping to partial wave expansions, and an outline of angular momentum decomposition at high energies are covered. (auth)

11039 (CONF-7309105-1) IMPROPER PROBLEMS IN DISPERSION RELATIONS. Ciulli, S. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 42p. Dep. NTIS (U. S. Sales Only) $5.00.

From international symposium on theoretical physics; Tehran, Iran (Sep 1973).

Elementary particle physics is an indirect science in the sense that, in contrast to the classical one, its ruling concepts are far beyond experimental reach. This often causes research to go through unstable ways (improper problems in the Hadamard sense) i.e., infinitely sensitive to the uncertainties of the input data. These indirect connections create a specific theoretical situation in which a twofold question arises. Namely one has first to find suitable stabilizing concepts which should control the instabilities of the inverse (unstable) problems and secondly, to look among all mathematically tautological ways of solving the (ideal) exact problem and which are rendered inequivalent by the existence of the uncertainties, in order to find that one which is least sensitive to the errors of the input data. The incidence of these questions in the various problems related to analytic continuation in particle physics are treated. (auth)

11040 (COO-3230-3) RESEARCH IN ELEMENTARY PARTICLE PHYSICS. Technical Progress Report, September 1, 1973–May 29, 1974. Kirsch, L. E.; Schnitzer, H. J. (Brandeis Univ., Waltham, Mass. (USA). Dept. of Physics). 1974. Contract AT(11-1)-3230. 13p. Dep. NTIS $4.00.

Research activities on theoretical and experimental properties of elementary particles are summarized. A list of publications is included. (JFP)

11041 (DESY-74-4) ASYMPTOTIC BEHAVIOUR AT EXCEPTIONAL MOMENTA. Thun, H. J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Feb 1974. 76p. Dep. NTIS (US Sales Only) $7.00.

A method is developed for investigating the asymptotic behavior of vertex functions at certain Minkowskian exceptional momenta. It is a direct generalization of earlier treatments of Euclidean exceptional momenta. It makes use of formal expansions in momentum space, closely related to light cone expansions in position space. The expansions have to be performed in those channels which carry finite total momentum squared and admit (in A^4-theory) two-particle intermediate states. (auth)

11042 (FAI-13) SOME POLARIZATION PHENOMENA IN A + x → B + y REACTION WITH POLARIZED INITIAL PARTICLES. Ots, I. (AN Ehstonskoj SSR, Tartu. Inst. Fiziki i Astronomii). 1972. 17p. INIS.

Formulas are obtained for the polarization moments of finite particles in the reaction A + x → B + y with polarization in one of the incident particles and for asymmetry in the angular distribution of the reaction products for polarization in both initial particles, when the polar diagram introduces a contribution to the amplitude of the reaction. The results are used in order to determine the spins of quasinuclear meson resonances. (SJR)

11043 (IFVE-STF-72-96) ANALYTICITY OF DIFFERENTIAL CROSS SECTION OF INCLUSIVE PROCESS FOR LOW MOMENTA OF PRODUCED PARTICLES. Rcheulishvili, G. L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 8p. (In Russian). INIS.

Consideration is given to the analytical properties of the differential cross section of the inclusive process $2 \to 3$ for small momenta of generated particles in the approximation of polar diagrams of ϕ^3 theory. (SJR)

11044 (IFVE-STF-73-3) QUARK MODEL FOR MULTIPARTICLE AND INCLUSIVE REACTIONS. Anisovich, V. V.; Shekter, V. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 29p. (In Russian). INIS.

Within the framework of the quark model inclusive reactions are considered at asymptotically large energies. Relations are written for the particle yield in various regions. This study deals with a description of the multiplicity of various hadrons within the framework of a "naive" quark model. This model was first proposed by Gell-Mann and Tsveig with the purpose of explaining hadron spectra and their statistical properties. Later after the studies of Levin, Frankfurt and Lipkin, Shek it was explained that this model may also be applied in studying hadron collision processes at high energies. With its aid it was possible to obtain a number of relations, which agreed well with experimental values, for cross sections of two-particle and quasi-two-particle reactions, and also for the total cross sections. (SJR)

11045 (INIS-mf-1319, pp 41-59, Pt. 9) KINEMATICAL CONSTRAINTS FOR INCLUSIVE REACTIONS. Predazzi, E. (Univ., Turin). 1972.

By inclusive reaction is meant a missing-mass experiment in which is analyzed the differential cross section of one (or few) of the produced particles, regardless of what else is produced. One problem faced is how relatively important are kinematical and dynamical effects. In an attempt to extract the kinematical effects from the problem, sum rules following from energy momentum conservation were derived and solved elsewhere in terms of the correlation functions. Consequences of these sum rules can be given both for specific problems as well as in general. This problem will be briefly reviewed. (auth)

11046 (JINR-E2-7819) SOME REMARKS ON LORENTZ INVARIANT VARIABLES FOR MANY-PARTICLE REACTIONS. Laurikainen, K. V.; Mihul, El. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

It is well known that for the Lorentz invariant description of many-particle states in addition to the simple invariants determinants of the components of four momenta deserve special attention. Some relations concerning these invariants for any n-particle reactions are given. The determinant of the 4-momenta of the four particles (or four unstable systems) from final state in the center of mass system of colliding particles is shown to have a simple geometrical interpretation, for both exclusive and inclusive reactions. (auth)

11047 (JINR-E2-7851) SELECTION RULES FOR DUAL RESONANCE STATES. Popov, Kh. D.; Stoyanov, D. Ts.; Tavkhelidze, A. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 28p. Dep. NTIS (US Sales Only) $4.50.

Some auxiliary conditions determining the dual states are found. These states arise when the dual amplitudes are factorized with the help of finite set of 5-dimensional oscillators. One of the above conditions has the form of a linear equation, which is both relativistic and SL(2,R) invariant. The general solution of this equation and some related mathematical questions are considered too. (auth)

11048 (JINR-P-7136) REPORT ON THE ACTIVITY OF THE JOINT INSTITUTE FOR NUCLEAR RESEARCH, DUBNA, 1972. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1973. 174p. (In Russian). Dep. NTIS (US Sales Only) $11.75.

The research studies made by the JINR in the areas of theoretical physics, high energy, nuclear structure and properties, nuclear physics, neutron physics, computer techniques, and new methods of acceleration are summarized. The participation of Dubna personnel in conferences and international organizations is indicated. (JSR)

11049 (JINR-P1-2-7642) PROCEEDINGS OF THE INTERNATIONAL SCHOOL OF YOUNG PHYSICISTS ON HIGH ENERGY PHYSICS, GOMEL, USSR, AUGUST 25-SEPTEMBER 5, 1973. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1973. 623p. (In Russian). (CONF-730860-).

The Proceedings include the cycles of 13 lectures presented on most important trends of high energy and elementary particle physics: on deep inelastic lepton-hadron interactions, strong interactions at high energies, inclusive reactions, phenomenology of multi-particle processes, quantum field theory problems (axiomatic approach, conformal invariant theories, gauge fields), electromagnetic interactions etc. (auth)

11050 (JINR-P2-7807) ISOTOPIC RELATIONS FOR TWO-PARTICLE INCLUSIVE REACTIONS. Lyuboshits, V. L.; Podgoretskii, M. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Based on the Shmushkevich method, model-free isotopic relations were obtained between the effective cross sections of two-particle inclusive processes and also between the second moments of the multiplicity distribution. It is shown that the two-particle structure functions averaged over all possible projections of the isotopic spin of primary particles are linear combinations of a final number of the independent nonnegative functions f_j (p_1, p_2) corresponding to a definite value of the isotopic spin of two particles. This makes it possible to obtain comparatively simply a series of new isotopic equalities and inequalities together with the already known relations. In particular, if particles belong to the same isotopic multiplet, the relation of symmetry automatically follows from a given formula. The general formulas obtained are applied to the inclusive reactions with the production of two $\pi(K)$-mesons. The analysis of the isotopic structure of spinless particle correlations with a small relative momentum. In this case some of the functions f_j (p_1, p_2) are close to zero, and the equalities are valid. (auth)

11051 (MATSCIENCE-78, pp 1-3b) GENERALIZED GELL-MANN-NISHIJIMA RELATIONS. Ramakrishnan, A. (Inst. of Mathematical Sciences, Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

A new viewpoint is given on the internal quantum numbers of the quarks, which have been postulated by Gell-Mann to be the fundamental constituents of the nucleons in the nucleus. (JFP)

11052 (MATSCIENCE-78, pp 48-65) NEW SPIN-$\frac{1}{2}$ WAVE EQUATION. Santhanam, T. S.; Tekumalla, A. R. (Inst. of Mathematical Sciences, Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

A recent equation for a spin-$\frac{1}{2}$ massive particle, an equation inequivalent to the Dirac equation and obtained by the techniques of higher spin, is studied. (JFP)

11053 (MATSCIENCE-78, pp 201-209) TRACE TECHNIQUES FOR ANGULAR MOMENTUM OPERATORS. Subramaniam, P. R.; Devanathan, V. (Univ. of Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

Traces of angular momentum matrices for arbitrary spin are derived using their well established properties. An interesting result, that the angular momentum matrices J_λ, J_μ $(\lambda \neq \mu)$ cannot anticommute when j is neither zero nor half, will simply follow from the formulas obtained. (auth)

11054 (RL-74-50) SOLVABLE ONE DIMENSIONAL MODELS OF PARTICLE PRODUCTION. Peccei, R. D. (Science Research Council, Chilton (UK). Rutherford High Energy Lab.). Apr 1974. 21p. Dep. NTIS (US Sales Only) $4.25.

A variety of simple one-dimensional models for particle production is discussed. For each of these models a closed form for the generating functional is derived which allows one to calculate the totality of inclusive, semi-inclusive and exclusive distributions. The models discussed include an n-trajectory multiperipheral model and a general cluster model. In this latter model a parameter independent relation between semi-inclusive and inclusive cross sections is derived. (auth)

11055 RECIPROCAL SYMMETRIES OF THE DUAL-RESONANCE PROPAGATORS. Minami, M. (Kyoto Univ.). Progr. Theor. Phys. (Kyoto); 50: No. 6, 2027-2039(Dec 1973).

It is explicitly shown that integral expressions of the dual-resonance propagators defined on two-dimensional (one-"space" and one-"time") media exhibit a detailed symmetry when the "space" axis and the "time" axis are interchanged in some sense with each other. For example, the dual-resonance propagator in momentum space proves to get a parametric integral representation of the form quite similar to the representation of the position-space propagator through this interchange. In particular, this reciprocal symmetry is shown to have an interesting connection with the recently known critical dimension of space for which no ghosts appear. It is likely that the sym-

metry has its origin in a graph-theoretical duality inherent in two-dimensional planar media, but its prototype may also be found in the well known properties of the conventional Feynman propagators. (auth)

11056 NONFACTORIZED MUELLER SINGULARITIES AND INCLUSIVE DISTRIBUTION. Bassetto, A. (Univ., Padua); Pasti, P. Nuovo Cim.; 21A: No. 3, 417-434(1 Jun 1974).

The possibility of describing inclusive distributions by means of a leading Mueller singularity which is not a factorized pole is studied. According to a "crossed-channel" viewpoint, a sort of a minimal violation of factorization is first examined, namely that the same singularity dominates multiple Mueller exchanges. Its consistency in inclusive sum rules is studied, paying particular attention to azimuthal correlations and discuss phenomenological consequences. Finally it is shown with explicit examples that this possibility is not verified in models for exclusive production amplitudes, based on direct-channel considerations. (auth)

11057 NON-CONVERGENCE OF RESONATING GROUP METHOD WITH APPROXIMATE CHANNEL FUNCTIONS. Schwager, J.; Schmid, E. W. (Univ., Tuebingen, Ger.). pp 392-395 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

It was recently stated (Nucl. Phys., A v. 180, p 434) that a variational scattering calculation for composite particles does not converge with respect to the addition of square integrable distortions, when approximate internal motion functions are used to describe the reaction partners asymptotically. Calculations are now made which confirm this statement. A model of three undistinguishable spinless particles interacting via a Hulthén potential is used. It is shown that in a resonating group calculation with approximate channel functions it is meaningful to include bound states and prominent resonances as distortions. It is not meaningful to add an arbitrary truncated set of square integrable functions. The latter should only be done when the channel functions are exact. (auth)

11058 EXPLORATORY DIP SYSTEMATICS IN ELASTIC SCATTERING. Tran Thanh Van, J. (Paris Univ., Orsay, France). pp 235-246 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

Regularity in the dip positions of many elastic differential cross sections is observed when the variable $X = -\sigma(\mathrm{tot})^2 t$ is used. Tentative justification is presented. (auth)

11059 NEW MODEL OF DIFFRACTIVE DISSOCIATION. Lubatti, H. J.; Moriyasu, K. (Univ. of Washington, Seattle). pp 411-432 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

A new model of diffractive dissociation is presented which explains most of the puzzling features of diffractive reactions. This model is based on an extension of the familiar Harari-Rosner dual quark diagrams. By introducing self-energy corrections to the bare hadron, new classes of dual diagrams are obtained. (auth)

11060 IMPORTANCE OF THE STRUCTURE OF THE POMERON. White, A. R. (CERN, Geneva). pp 105-124 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The derivation of the two-Pomeron cut discontinuity and decoupling results for Pomeron vertices from both the t-channel and the s-channel is discussed. It is emphasized that it is essential to consider the structure of the Pomeron in terms of its s-channel intermediate states, if consistency between the s- and t-channel results is to be achieved. (auth)

11061 LIGHT CONE SINGULARITIES AND THE ASYMPTOTIC BEHAVIOR OF MATRIX ELEMENTS OF OPERATOR PRODUCTS IN MOMENTUM SPACE. Schwarz, F. (Univ., Kaiserslautern, Ger.). Fortschr. Phys.; 21: No. 5, 205-263(1973).

The discussion covers asymptotic expansions of Fourier integrals with light cone singularities, and physical applications for products of two- and three-field operators. (JFP)

11062 PRODUCTION IN THE CENTRAL REGION. Wang, J. M. (State Univ. of New York, Stony Brook). pp 579-582 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From Eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

Multiplicity distributions in a finite section of momentum space of the central region are discussed. (auth)

11063 CLUSTERINGS IN HADRONIC PRODUCTION AND MARKOVIAN WALK. Tan, C. I. (Brown Univ., Providence). pp 563-577 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The approach to the scaling limit of the inclusive cross sections in the central region is correlated with the local clustering effect in the rapidity distribution. An explicit model is constructed where the scaling limit can be approached from below. This is then explained from the point of view of Markovian walk in one-dimension. (auth)

11064 MODEL OF THE BREAKING OF HAGEDORN THEORY AND SCALING AT HIGH TRANSVERSE MOMENTUM. Dethlefsen, J. M.; Dias de Deus, J.; Nielsen, H. B. (Niels Bohr Institutet, Copenhagen). pp 535-549 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

It is argued that the parton model suggests a deviation from the exact Hagedorn thermodynamic model. This in turn leads to a deviation for the large transverse momentum inclusive spectrum from the Planck spectrum expected from the Hagedorn theory. A model in which fireballs are produced by collisions of partons in the beam and in the target is used. These fireballs then decay under successive emission of pions, say, with a decreasing temperature. Good agreement with ISR data is obtained. (auth)

11065 TWO-REGGEON CUT PROBLEMS. Kang, K. (Univ., Paris). pp 491-497 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The two-Reggeon cut problem is reviewed in the light of recent developments concerning the notion of two-Reggeon irreducibility. (auth)

11066 IMPACT PARAMETER DESCRIPTION OF MULTIPARTICLE AND ELASTIC SCATTERING, WITH AN APPLICATION TO THE MULTIPERIPHERAL MODEL. Henyey, F. S. (Univ. of Michigan, Ann Arbor). pp 463-490 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (ed.). Orsay, France; Univ. Paris (1973).

From eighth Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

Impact parameter variables are defined for a multiparticle production process. The equation of unitarity for elastic scattering is written at high energy in terms of these variables. The overall impact parameter can be expressed in terms of the impact parameters of all the produced particles. The unitarity equation becomes an optical theorem at each impact parameter; diffractive scattering is given by beam depletion. These features allow this technique to give a much clearer interpretation of unitarity in any model than has heretofore been possible. As an application of this technique, the multiperipheral model is examined. Short range order is shown to be equivalent to a random walk in impact parameter. Short range order, with an energy independent correlation length, is shown to be inconsistent with the combination of elastic and multiparticle data. Alternative models are suggested by use of this technique. (auth)

11067 SOME ASPECTS OF THE QUARK PARTON MODEL. McElhaney, R. (Univ. of Wisconsin, Madison); Tuan, S. F. Nucl. Phys.; B72: No. 3, 487-501(1974).

A modified Kuti-Weisskopf model which satisfies the Feynman threshold constraints is considered further. Detailed predictions for the sum of neutrino and anti-neutrino differential cross sections on nucleon (which can be readily compared with forthcoming NAL data), the shapes of the structure functions $f_2^{ep,en}$ and the ratio f_2^{ep}/f_2^{en}, and spin-dependence of inelastic electron-nucleon scattering versus scaling variable x are delineated. Also the general features of the model are compared in some detail with the "model independent" approach of Feynman for quark parton theory. (auth)

11068 STABILITY PROBLEMS IN ANALYTIC CONTINUATION. Ciulli, S. (Inst. for Atomic Physics, Bucharest). pp 70-

105 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer institute on theoretical physics meeting; Kaiserslautern, F. R. Germany (17 Jul 1972). See CONF-720738-.

The discussion covers optimization of polynomial extrapolations, weighted dispersion relations, Cutkosky probabilistic approach, Atkinson–Johnson–Warnock bootstrap, and optimal N/D integral equations. (JFP)

11069 SOME GENERAL ASPECTS OF MULTIPERIPHERAL DYNAMICS. Toller, M. (CERN, Geneva). pp 196-218 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer institute on theoretical physics meeting; Kaiserslautern, F. R. Germany (17 Jul 1972). See CONF-720738-.

The assumptions, the structure, and the mathematical formalism of multiperipheral dynamics are reanalyzed in the lectures presented. A short exposition of previously known results is added when necessary to obtain a self-contained treatment. Suitable assumptions on the production amplitudes are made, and the total cross section and the inclusive distributions are derived by integration over the momenta and sum over the multiplicity. A more detailed treatment is given to a proposed characterization of the multiperipheral amplitudes by means of a factorized upper bound and some improvements in the O(3,1) projection of the multiperipheral integral equation based on the properties of a semigroup. (JFP)

11070 HIGH ENERGY PHYSICS INDEX. Volume 12, Nos. 1-2, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 93p.

11071 HIGH ENERGY PHYSICS INDEX. Volume 12, No. 3, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 84p.

11072 HIGH ENERGY PHYSICS INDEX. Volume 12, No. 4, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 92p.

11073 HIGH ENERGY PHYSICS INDEX. Volume 12, No. 6, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 91p.

11074 HIGH ENERGY PHYSICS INDEX. Volume 12, No. 7, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 88p.

11075 HIGH ENERGY PHYSICS INDEX. Volume 12, No. 9, 1974. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 87p.

11076 TOPICS IN THE INCLUSIVE PHENOMENOLOGY. Kang, K. (Institut de Physique Nucleaire, Paris). Fortschr. Phys.; 21: No. 10, 507-557(1973).

The discussion covers exclusive and inclusive cross sections, inclusive sum rules and some elementary consequences, inclusive and exclusive functionals, known properties in experiments, kinematics and choice of variables, and the hypothesis of scaling and limiting fragmentation. Also the Feynman–Wilson gas analog, Mueller's Regge hypothesis, energy dependence of the inclusive cross sections, single-particle production in the dual-resonance model, and further analysis of the dual resonance model are treated. (JFP)

11077 DYNAMICAL MODEL OF REGGE TRAJECTORIES. Threshold Behavior and Linearity. Fleming, H. (Sao Paulo Univ., Brazil). Rev. Brasil. Fis.; 3: No. 1, 47-58(May 1973).

A model for dominant Regge trajectories is discussed, both on theoretical and on experimental grounds. It is based on analyticity and unitarity and gives trajectories that are almost linear. The intercept is related to the asymptotic behavior and, as the trajectory approaches a straight line, the intercept approaches ½. (auth)

11078 ANOMALOUS GREEN'S FUNCTIONS IN A THEORY OF SELF-INTERACTING WEYL SPINORS. Saller, H. (Cornell Univ., Ithaca, NY). Nuovo Cim.; 21A: No. 4, 661-686(Jun 1974).

In order to introduce gauge invariance into a theory of self-interacting Weyl spinors also in a perturbative solution, a pair formalism with anomalous Green's functions is introduced. This leads to a peculiar regularization mechanism. Anomalous Green's functions can also be used to introduce parity into the theory as a concept which is only useful for large distances. Parity-violating effects, however, remain everywhere as a memory of the asymptotic theory. The only interactions which are not troubled by these parity problems are mediated by massless gauge bosons which arise as bound states with negative parity in the model. (auth)

11079 SELF-CONSISTENT EXCHANGE-DEGENERACY RELATIONS AND ACCIDENTAL EARLY SCALING IN INCLUSIVE REACTIONS. Chaichian, M.; Lam, W. S. (Univ. of Bielefeld, Ger.). Nuovo Cim.; 21A: No. 4, 639-646(21 Jun 1974).

A set of self-consistent exchange-degeneracy relations for single-particle fragmentation vertices is derived from the exoticity criterion of Chan et al. and factorization of secondary Regge exchanges. It is shown that there are many reactions with (abc̄)-channel nonexotic but which will exhibit early scaling owing to the exact cancellation of the contributions from the secondary Regge exchanges ("accidental" early scaling). Existing data are found to be in agreement with predictions from these exchange-degeneracy relations. Further tests are suggested. Predictions for early scaling in two-body inclusive reactions are also discussed. (auth)

11080 ABSORPTION MODEL WITH CORRECT REGGE CUT BRANCH POINT BEHAVIOR. Collins, P. A.; Williams, R. M. (Imperial Coll. of Science and Tech., London). J. Phys., A (London); 7: No. 6, 710-717(11 Apr 1974).

The effect of modifying the absorption model, as suggested by Guerin (Nucl. Phys.; B49: 557 (1972)), to give Regge cuts with the correct branch point behavior is investigated. The integrals are reduced to a form which makes application of the modified model practicable. (auth)

11081 FLUCTUATIONS IN MULTIPLE PRODUCTION PROCESSES. Rozental, I. L. Yadern. Fiz.; 19: No. 5, 1098-1102 (May 1974). (In Russian).

Fluctuations in angular distributions of secondary particles produced in multiple processes are considered. The analysis is fulfilled in framework of the hydrodynamical model. (auth)

11082 FORM FACTOR OF COMPOUND PARTICLES IN THE QUANTUM MECHANICS AT LARGE MOMENTUM TRANSFERS. Karnakov, B. M. (Moscow Engineering-Physics Inst.). Yadern. Fiz.; 19: No. 5, 1122-1135(May 1974). (In Russian).

The asymptotics of the wave functions of many-particle systems are considered in the impulse approximation. It is shown that under definite restrictions on the pairing potentials the asymptotics can be simply obtained from the Schrödinger equation in the impulse approximation. The results are used to study the dependence of the electric form factors of compound systems at high momentum transfers upon the number of "elementary" particles involved in the system and upon the momentum of compound particles. It is noted that this dependence is very simple if the Fourier components of the pairing potentials decrease exponentially. (auth)

11083 SCALING–CHIRAL SUM RULES. Dao Vong Duc. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 19: No. 5, 1115-1121(May 1974). (In Russian).

The sum rules for the spectral functions ρ_0, ρ_s, ρ_κ, as well as for the sigma terms, are considered under certain assumptions about the behavior of the Hamiltonian density under the scaling and chiral transformations. (auth)

11084 COMMENTS ON THE HIGH ENERGY BEHAVIOR OF TOTAL CROSS SECTIONS BASED ON LIGHT-CONE ALGEBRA. Das, T.; Pandit, L. K.; Roy, P. (Tata Inst. of Fundamental Research, Bombay). Pramana; 2: No. 2, 80-83(Feb 1974).

Based on considerations of the light-cone algebra of currents and pseudoscalar densities, it is suggested that either the high energy meson-nucleon cross-sections are constants (even though the pp-cross-section increases indefinitely) or that they deviate from constancy by logarithmic terms whose scale is set by a mass, of the order of at least tens of GeV, and which also characterizes the consequent logarithmic violations of Bjorken scaling. (auth)

Electromagnetic

Refer also to abstracts 11768 and 11770.

11085 (COO-3071-88) ELECTROMAGNETIC INTERACTION OF NEUTRINOS IN GAUGE THEORIES OF WEAK INTERACTIONS. Cung, V. K.; Yoshimura, M. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 9 Apr 1974. 15p. Dep. NTIS $4.00.

The scattering of neutrinos off real or virtual photons is examined in the gauge theories of weak interactions. Finite amplitudes of order $G\alpha$ are calculated in the fourth order perturbation for various models. (auth)

11086 (DESY-74-10) QUARK FRAGMENTATION FUNCTIONS IN HADRONIC AND DEEP INELASTIC SINGLE PARTICLE INCLUSIVE PROCESSES. Flume-Gorczyca, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Mar 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

In the framework of Feynman's quark-parton model for inclusive electroproduction and quark model of Ezawa, Maharana and Miyazawa for hadronic inclusive processes, relations between invariant cross sections for electroproduction of pions and purely hadronic production of pions in the beam fragmentation regions are derived. They are satisfied by data. The ratio of parton fragmentation functions $\eta = D_u^{\pi^+}(z)/D_d^{\pi^+}(z)$ is estimated from purely hadronic processes independently from the parton model. (auth)

11087 (EFI-9-72) HIGH-ENERGY CONTRIBUTIONS TO THE DISPERSION INTEGRALS, ISOTENSOR ELECTROMAGNETIC CURRENT, AND DATA ON π^+ PHOTOPRODUCTION FROM THE THRESHOLD UP TO 450 MeV. Aznauryan, I. G.; Zaslavskii, A. N. (Erevanskij Fizicheskij Inst. (USSR)). 1972. 23p. INIS.

The discrepancy between theory and experimental data on the reaction $\gamma n \rightleftharpoons p\pi^-$, observed by a number of authors, was eliminated by calculation of high energy contributions to the dispersion integrals. Experimental data on the differential cross section of the photoproduction of π^+ mesons from the threshold to 450 MeV were obtained. Some dispersion that remains with $E_\gamma = 350$ MeV, $\theta = 90°$, may be related to the existence of an isotensor electromagnetic current, values of which were determined. (tr-auth)

11088 (IFVE-STF-72-105) INCLUSIVE REACTIONS OF HADRON PHOTOPRODUCTION IN THE FRAMEWORK OF QUARK MODEL. Kobrinskii, M. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 9p. (In Russian). INIS.

Consideration is given to various possibilities of describing processes of the inclusive photoproduction of hadrons within the framework of the quark model. It is shown that by the use of this model fortified by the hypothesis of vector dominance it is possible to describe experimental inclusive cross sections of photoproduction in the region of fragmentation without introducing any additional free parameters. (SJR)

11089 (IFVE-STF-72-111) LOW-ENERGY THEOREMS IN S-MATRIX ELECTRODYNAMICS. Pron'ko, G. P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 16p. (In Russian). INIS.

Within the framework of S-matrix electrodynamics it was possible to find all terms in the decomposition of the matrix element of bremsstrahlung radiation according to photon energy which do not depend on the model. Analogous decompositions were obtained for processes with a virtual charged particle. By means of decompositions obtained for the matrix element of bremsstrahlung radiation it is shown that the threshold theorem of Loy, Gellmann, and Goldberger for Compton scattering on a charged particle with spin 0 is correct for all orders of magnitude in electromagnetic interaction. (SJR)

11090 (IFVE-STF-73-16) LOW-ENERGY PHOTONS IN S-MATRIX ELECTRODYNAMICS. Pron'ko, G. P.; Solov'ev, L. D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 31p. (In Russian). INIS.

The axiomatic approach of Bogolyubov is generalized in order to take into account the electromagnetic interaction. The study introduces physical matrix elements of operators satisfying equations without infrared divergences. By means of these equations it was possible to find all members of a decomposition of the physical matrix element of bremstrahlung radiation according to radiation energy, which are determined with a standardized invariantness. The consequences of this decomposition are considered. It is shown that the taking into account of the soft photons does not violate the dispersion relations for physical matrix elements of elastic processes. In this case the perturbation theory according to strong or electromagnetic interactions is never used. A discussion is carried out on the physical bases of this approach, its possible applications and connection with the method of asymptotic states. (SJR)

11091 (INIS-mf-1317, pp 73-91, Pt. 11) UNIFIED SOLUTION TO THE $\pi^0 \rightarrow 2\gamma$ AND $\eta \rightarrow 3\pi$ DECAY PUZZLES. Mendes, R. V. (Junta de Energia Nuclear, Sacavem, Portugal). 1972.

A brief review is given of the $\pi^0 \rightarrow 2\gamma$ and $\eta \rightarrow 3\pi$ puzzles in current algebra. It is shown how they find a simple solution in the framework of a model originally proposed to generate algebraic Schwinger terms in the quark model. A sum rule is derived that relates the $\pi^0 \rightarrow 2\gamma$ decay width extrapolated to zero pion mass and the total e^+e^- annihilation cross section. The sum rule is experimentally evaluated, and its predictions concerning the asymptotic behavior of $\sigma(e^+e^- \rightarrow \text{hadrons})$ discussed. (auth)

11092 (INIS-mf-1318, pp 1-39, Pt. 9) DEEP INELASTIC ELECTRON SCATTERING. MacDowell, S. W. (Yale Univ., New Haven). 1972.

Inelastic scattering of high energy electrons by protons and deuterons provides an important tool to investigate the structure of the nucleon, and the nature of interactions at very short distances. The following are discussed: the kinematics of electron scattering by nucleons, the properties of the inelastic structure functions, and the scattering of polarized electrons. A summary of experimental results and a brief discussion of their main features is given. Finally a review is presented of some phenomenological models—the parton model and the quark model. (auth)

11093 (JINR-P2-7702) CASCADE-EVAPORATION MODEL FOR PHOTONUCLEAR REACTIONS. Barashenko, V. S.; Zheregi, F. G.; Il'inov, A. S.; Jonsson, G. G.; Toneev, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 26p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

Detailed and systematic Monte-Carlo calculations were performed for different characteristics of inelastic photonuclear reactions for an energy range from 50 MeV up to 1.3 GeV in the framework of the intranuclear cascade model taking into account the competition between particle evaporation and fission of excited residual nuclei. The calculated results agree well with experimental data. On the basis of the data listed it is possible to extrapolate the corresponding characteristics for intermediate energies and nuclei. (auth)

11094 (MATSCIENCE-78, pp 37-39) UNIFIED DESCRIPTIONS OF ELECTROMAGNETIC AND WEAK INTERACTIONS AND LEPTONIC QUARKS. Santhanam, T. S. (Inst. of Mathematical Sciences, Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

An alternative solution to a recently advocated "symmetry clash" in unified theories of electromagnetic and weak interactions is proposed. The model introduces leptonic quarks. (auth)

11095 (RL-74-56) η_{+-} AND THE REACTION $e^+e^- \rightarrow K^0\bar{K}^0$ AT THE ϕ-RESONANCE. Dass, G. V. (Science Research Council, Chilton (UK). Rutherford High Energy Lab.; Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Apr 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

$|\eta_{+-}|$ can be rather cleanly determined in $e^+e^- \rightarrow K^0\bar{K}^0$ at the ϕ-resonance position from the time-distribution of decays of one of the produced kaons within a suitable angular portion of a hemisphere. The procedure is better than the existing methods. (auth)

11096 (SLL-74-12) SANDYL: A COMPUTER PROGRAM FOR CALCULATING COMBINED PHOTON-ELECTRON TRANSPORT IN COMPLEX SYSTEMS. Colbert, H. M. (Sandia Labs., Livermore, Calif. (USA)). May 1974. Contract AT(29-1)-789. 122p. Dep. NTIS $9.25.

The theory and operational features of the three-dimensional Monte Carlo code SANDYL are described. The code does time- and space-dependent transport calculations of the photon-electron cascade in complex systems. All generations of particles in the 1-keV to 1000-MeV energy range are followed. (auth)

11097 CHIRAL SU(4) × SU(4) GAUGE THEORY OF WEAK AND ELECTROMAGNETIC INTERACTIONS. Eliezer, S.; Ross, D. A. (Impirial Coll. of Science and Tech., London). Nucl. Phys.; B73: No. 2, 351-364(1974).

A lepton hadron analogy is considered based on the gauge group $SU(4)_L \times SU(4)_R \times U(1)$, which is broken entirely spontaneously. The model satisfies the physical requirements of the V-A theory, muon-electron universality, no neutral strangeness changing currents, the Cabibbo structure for the SU(3) currents, and triangle anomalies can be avoided. The contribution of the existing neutral currents to various neutrino processes are calculated. (auth)

11098 QUARK-PARTON MODEL RELATIONS IN DEEP INELASTIC LEPTON SCATTERING. Barger, V. (Univ. of Wisconsin, Madison); Phillips, R. J. N. Nucl. Phys.; B73: No. 2, 269-294(1974).

A complete listing of the quark-parton model relations among deep inelastic lepton-nucleon scattering processes is given, to be compared with forthcoming neutrino and antineutrino data. The stronger relations that come from specializing in various ways, including antiquark and strange quark suppression, and the dual valence plus sea model are also noted. Finally illustrative parametrizations, fitted to the electron data and minimizing the antiquark momentum content, are constructed in accord with early results for the neutrino/antineutrino cross-section ratio. (auth)

11099 EXPLICIT FORMULA FROM FIELD THEORY FOR THE AVERAGE INTRINSIC SIZE OF A REAL OR VIRTUAL PHOTON. Griffith, R. W. (Univ., Bonn). Nuovo Cim.; 21A: No. 3, 435-470(1 Jun 1974).

In terms of certain spectral moments which involve the total e^+e^- annihilation cross-section $\sigma_{e^+e^-}(S)$, an explicit formula is derived for the intrinsic mean square radius $\langle x^2\rangle_{q^2}$ of a real or virtual photon (Q^2 is the spacelike photon mass squared). The radius measures an average spatial extension which is induced by the photon's virtual hadronic couplings. If $\sigma_{e^+e^-}(s)/\sigma(e^+e^- \to \mu^+\mu^-) \sim cs^\eta$ as $s \to \infty$, where $-\frac{1}{2} < \eta < \frac{1}{2}$ (and c is a constant), then $\langle x^2\rangle_{q^2} \sim \Psi(\eta)/Q^2$ when $Q^2 \to \infty$, where the constant coefficient $\Psi(\eta) \equiv (\frac{1}{2}-\eta)/(\frac{1}{2}+\eta)$. For example, in the case of "pointlike" behavior of $\sigma_{e^+e^-}(s)$ for which $\eta \equiv 0$, $\Psi(0) \equiv 1$ and $\langle x^2\rangle_{q^2} \sim 1/Q^2$ as $Q^2 \to \infty$. A similar formula for the on-mass-shell pion (in any isospin state) yields an upper bound $\langle x^2\rangle_\pi^{1/2} < (1/\sqrt{3})(\hbar/m_\pi c) \simeq 0.82$ fm. Phenomenological applications are made of $\langle x^2\rangle_{q^2}^{1/2}$ to diffraction slopes and cross-sections in virtual Compton scattering and in the virtual photoproduction process of a vector system (in particular, $\gamma(Q^2)p \to \rho^0 p$). (auth)

11100 INVARIANT SPECTRUM FOR THE EQUIVALENT-PHOTON METHOD. Bonneau, G.; Martin, F. (Laboratoire de Physique, Paris). Nuovo Cim.; 21A: No. 3, 611-622(1 Jun 1974).

The equivalent-photon method is carefully studied and formulated in an invariant way for electroproductionlike processes. The invariant spectrum obtained is specified for two interesting limits: infinitely heavy target and quasi-real photon target. An application to the two-photon mechanism for the production of a state of effective mass W is given and the fixed-W^2 cross section is computed. (auth)

11101 ELECTRON-POSITRON ANNIHILATION INTO HADRONS AND LANDAU'S HYDRODYNAMIC MODEL. Cooper, F.; Frye, G. (Belfer Graduate School of Science, Yeshiva University, New York, New York 10033); Schonberg, E. Phys. Rev. Lett. 32: No. 15, 862-865 (15 Apr 1974).

The multiplicity and inclusive single-particle distribution for $e^+ + e^- \to \pi + X$ are calculated for Landau's hydrodynamic model. At 3 and 5 GeV the collective motion is less important than the thermal motion. The average pion energy obtained in the Stanford linear-accelerator colliding-beam experiment is consistent with either an ultrarelativistic equation of state or one based on the observed hadron spectrum. (auth)

11102 ASYMPTOTIC BEHAVIOR OF THE PION ELECTROMAGNETIC FORM FACTORS IN BETHE-SALPETER MODEL. Biswas, S.N.; Singh, S.; Vidhani, T. (Department of Physics and Astrophysics, University of Delhi, Delhi 110007, India). Ann. Phys. (N.Y.) 83: No. 1, 158-168 (Mar 1974).

Asymptotic behavior of the pion form factors has been discussed treating pion as a bound state of the elementary nucleon and antinucleon system. The matrix-element of the electromagnetic current is written in terms of the Bethe-Salpeter amplitude for the nucleon-antinucleon bound system. Using suitable approximations the Bethe-Salpeter equation for nucleon-antinucleon bound state with nucleons as Dirac spinors has been solved and the corresponding off-shell pion form factors are determined. The form factors are strongly interaction dependent. For coupling $g^2/16\pi^2 = 15/4$ the form factors vanish asymptotically like t^{-1} and for $14/4 < g^2/16\pi^2 < 15/4$ the form factors still vanish but less rapidly than t^{-1}. (auth)

11103 POLARIZATION EFFECTS IN THE SCATTERING OF LEPTONS BY HADRONS. Akhiezer, A. I.; Rekalo, M. P. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. J. Particles Nucl.; 4: No. 3, 277-287(Jan 1974).

Polarization effects due to elastic and inelastic scattering of high-energy leptons by hadrons are discussed. (auth)

11104 HADRON VACUUM POLARIZATION EFFECT FOR MUON PAIR PRODUCTION IN POSITRON-ELECTRON COLLISION. Iwao, S. (Kanazawa Univ., Japan); Shako, M. Lett. Nuovo Cim.; 9: No. 17, 693-696(27 Apr 1974).

The effect of vacuum polarization of hadrons for muon pair production in positron-electron interactions by taking into account the well-established vector mesons, ρ, ω, ϕ, and ρ' (1600) is investigated. In addition to a general investigation of the effect for the lowest-order QED mechanism, particular attention is given to the vacuum polarization due to ω-meson so as to determine the associated parameters including ρ-ω interference effect. (LBS)

11105 ELECTROMAGNETIC-MASS DIFFERENCE OF PIONS IN UNIFIED GAUGE FIELD THEORIES. Palla, L.; Pocsik, G. (Eotvos Univ., Budapest). Lett. Nuovo Cim.; 10: No. 5, 174-176 (1 Jun 1974).

The cancellation of logarithmically divergent terms in the electromagnetic mass shift of soft and hard pions in unified gauge field theories is examined. (LBS)

11106 CAN THE HIGGS-KIBBLE MECHANISM EXPLAIN THE ELECTRON-MUON PUZZLE. Gromes, D. (Univ., Heidelberg). Lett. Nuovo Cim.; 10: No. 5, 209-213(1 Jun 1974).

Models of Higgs fields are proposed where the potential has more than one minimum. Different types of solutions are found, which lead to different possible values for the mass of a coupled fundamental lepton field. The models lead in a natural way to electron-muon universality and predictions concerning the couplings of scalar particles to leptons are obtained. The smallness of the electron mass comes out naturally, whereas the e-μ mass ratio remains an open question. (LBS)

11107 RANGE, LIGHT-CONE DOMINANCE AND SCALING AT LOW Q^2 IN ELECTROPRODUCTION. Jaffe, R. L. (Stanford Univ., CA). Ann. Phys. (N. Y.); 75: No. 2, 545-561 (Feb 1973).

The analysis of light cone singularities is used to connect the $y \cdot P$, or range, dependence of the current correlation function with the Q^2 dependence of the inelastic electroproduction structure functions. We study for what regions of the Q^2, ν plane and for what $y \cdot P$ dependence the leading light-cone singularity dominates contributions from less singular terms with the same $y \cdot P$ dependence. When the leading singularity can be shown to dominate for a particular region of Q^2 and ν, we study whether this implies scaling for νW_2 in that kinematic region. It is shown that a division of the current correlation function into short and long range contributions is fundamentally ambiguous and not related to scaling at low Q^2. Short range terms which are shown to be light-cone dominated for all Q^2 so long as $\nu \to \infty$, are found but are shown not to scale at low Q^2 and to be indistinguishable from corrections to long range terms which produce the leading Regge behavior. We show that leading Regge terms may receive contributions far away from the light cone for small virtual photon mass, but that light-cone dominance and scaling are recovered when the photon mass is taken very large. (auth)

11108 RELATIVISTIC PARTICLE MOTION IN NONUNIFORM ELECTROMAGNETIC WAVES. Schmidt, G.; Wilcox, T. (Univ. of California, Los Angeles). Phys. Rev. Lett.; 31: No. 23, 1380-1383(3 Dec 1973).

It is shown that a charged particle moving in a strong nonuniform electromagnetic wave suffers a net acceleration in the direction of the negative intensity gradient of the wave. Electrons will be expelled perpendicularly from narrow laser beams and various instabilities can result.

11109 MESON-EXCHANGE EFFECTS IN NEUTRON-PROTON BREMSSTRAHLUNG. Brown, V. R. (Univ. of California, Livermore); Franklin, J. Phys. Rev., C; 8: No. 5, 1706-1720(Nov 1973).

A prescription for including exchange effects in neutron-proton bremsstrahlung (npγ) by requiring gauge invariance of the complete npγ amplitude is given entirely within a potential framework. To lowest order in the photon momentum (K^0) this prescription is unambiguous; and it includes, as well as exchange effects, any other other nonlocal effects in the nuclear potential. The lowest-order contribution is written, with the use of the Schroedinger equation, so as to eliminate the necessity of integrating over the nuclear potential. The higher-order exchange contributions are treated through order K^2 by using the one-pion exchange (OPE) only. (Because the effective expansion is K/μ, where μ is the mass of the exchanged meson, the pion is expected to dominate.) These higher-order terms are the same as the Feynman-diagram prescription would give for npγ due to OPE. Calculations with the Hamada-Johnston (HJ) and Bryan-Scott III (BS) potentials are compared with the experimental results at 208 MeV by Brady et al. and at 130 MeV by Edgington et al. This inclusion of the exchange bremsstrahlung (order K^0) increases the cross section by roughly a factor of 2, providing generally good agreement with both experiments. An estimate of the order-K^2 terms indicates that they contribute <2%; possible implications of this result on order-K contributions are discussed. Contributions arising from nonlocal terms other than exchange, such as momentum-dependent and spin-orbit effects, amount to about 1%. There is little difference between the npγ predictions for the HJ and BS potentials. These npγ coplanar results for the HJ potential are compared with those obtained in a calculation, which uses the low-energy theorem for internal radiation, by Celenza et al. (auth)

11110 FIREBALL-ANALYSIS OF THE GAMMA-RAY FAMILIES IN HIGH ENERGY NUCLEAR INTERACTIONS. Sato, Y. (Waseda Univ., Tokyo). Uchusen Kenkyu; 18: No. 1, 2-21(Aug 1973). (In Japanese).

The results of fireball analysis of γ-ray families to investigate into the ambiguity seen in previous works, and to obtain Mγ-spectrum, where Mγ means the fireball rest energy released

into γ-ray. The data used for the analysis were those by Bristol–Bombay group, Kobe group and A.E.C. The events included in the range of transverse momentum $P_{T\gamma}$ between 0.1 and 0.3 GeV/c were used for the analysis. M_γ distribution was obtained with a fitting program by nonlinear least square fitting method. The distribution was broad over the range between 1 and 10 GeV. A dip between 3 and 4 GeV reported previously was not observable in the present result. It will be necessary for the conclusion on the dip to make further analysis for larger M_γ. (Kato, T.)

11111 RELATIVITY AND QUANTIZATION. V. A Second Unified Field Model of a Charged Particle (A Hypothetical Model of a Charged Antiparticle Model OK_2^-). Anastassov, A. H. (Univ., Sofia). Nuovo Cim.; 21B: No. 1, 151-154(11 May 1974).

This is an investigation based on the previous model OK_2^+. In the OK_2^--model the total energy within the sphere r < b is negative and divergent. The energy outside the sphere r > b is positive and divergent. The two divergences cancel and the total energy becomes M_0c^2. The effective gravitational mass turns out to be negative. (auth)

11112 RELATIVITY AND QUANTIZATION. VI. Quantum-Relativistic Unified Field Model of a Charged Particle (Model OK_3^+). Anastassov, A. H. (Univ. of Sofia). Nuovo Cim.; 21B: No. 1, 155-161(11 May 1974).

A nonstatic, sphero-symmetrical pulsing metric ($\overline{OK}_3^+$) is studied. Averaged over t, this metric represents a unified field model of a charged particle. Simple relations exist between the parameters of the particle and the parameters of the metric's impulses. A generalization of this metric leads to a hypothetical model of a nucleon. (auth)

11113 DISPERSION RELATION APPROACH TO THE ANOMALOUS MAGNETIC MOMENT IN GAUGE THEORIES. Kato, M.; Wada, H. (Tokyo Univ.). Nucl. Phys.; B73: No. 2, 237-256(1974).

The reason why the dispersion relations for the anomalous magnetic moment are not valid in gauge theories is explained. New sum rules are derived based on unitarity bounds of scattering amplitudes. In gauge theories these sum rules give the correct values for the anomalous magnetic moment, while, in the case of conventional renormalizable theories which contain no massive vector bosons, they are identical with the usual dispersion relations for the anomalous magnetic moment. (auth)

11114 CURRENTS ON THE LIGHT CONE. Leutwyler, H. (Univ., Bern). pp 245-269 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer institute on theoretical physics meeting; Kaiserslautern, F. R. Germany (17 Jul 1972). See CONF-720738-.

Lectures are given on an elementary introduction to some topics in light cone physics, in particular electron-proton scattering. Only applications which do not involve dynamical assumptions beyond those inherent in light cone physics are discussed. (JFP)

11115 HADRONIC FEATURES OF THE PHOTON IN γ*N AND γ*γ* REACTIONS. Schlereth, H. (Technische Hochschule, Aachen). Lett. Nuovo Cim.; 10: No. 3, 97-105(18 May 1974).

The basic formulas of the generalized vector-meson dominance model are first described for the inclusive reactions $\gamma^*N \to h\,X$. An attempt is then made to extend the basic idea of the model to reactions of the type $\gamma^*(q_1^2)\,\gamma^*(q_2^2) \to h\,X$, taking into account the possibility that $\gamma^*(q_2^2)$ in the pertinent kinematical region itself behaves as a hadron. Results that can be obtained from the formulas are then discussed. (LBS)

11116 RADIATION AND QUANTUM PHYSICS. Ingram, D. J. E. Oxford; Clarendon Press (1973). 107p.

Radiation in all its different forms is dealt with at first year University level under various topics which include the electromagnetic spectrum; the radiation laws and Plancks postulate; energy-distribution and the ideas of statistical mechanics; the photoelectric and Compton effects; Bohr's theory and its limitations; and the wave particle aspect of matter and energy, linked with the uncertainty principle and an introduction to the basic methods of wave mechanics. (UK)

11117 MONTE CARLO CALCULATION OF SECONDARY ELECTRON. An Attempt at Elucidation of Gamma-Ray Irradiation Effect. Kaminishi, T.; Minato, S. (Government Industrial Research Inst., Nagoya, Japan). Genshiryoku Kogyo; 19: No. 10, 43-45(Oct 1973). (In Japanese).

In the investigation of γ irradiation effect, the state of the electrons generated in secondary process is not yet sufficiently unknown. The simulation by a computer will be useful in theoretical development. A number of electrons are generated till the incident photons to a material come to the end of their lifetime. These electrons are also absorbed in the material, or end their life by being emitted from boundaries, after repeating the interaction with the material. It is essentially necessary for simulating these conditions to determine the distance photons (or electrons) travelled before collision occurs, and the change of their direction and energy at collision points. Monte Carlo calculation is the method to determine these factors one by one by using random number. The results of the calculation indicated good similarity in the form of spectrum as compared with actual measurement. To improve accuracy, however, increase of the number of incident photons is required, but it necessitates the significant increase of computing time, thus leads to the limitation in the actual practice of Monte Carlo simulation. (auth)

11118 MANY-TIMES FORMALISM AND COULOMB INTERACTION. Marx, E. (Henry Diamond Labs., Washington, DC). Int. J. Theor. Phys.; 9: No. 3, 195-217(Mar 1974).

The many-times formalism, formerly used mainly for particles moving in given classical fields is extended to interacting particles. In order to minimize the difficulties associated with an equal-time interaction, the discussion is limited to nonrelativistic quantum mechanics and a two-particle interaction, such as that corresponding to the Coulomb force between charged particles. A set of differential equations are obtained which are really not consistent, but they serve as a guide to a formulation in terms of integral equations that has the same perturbation expansion as the usual theory for the scattering of particles. The integral equation for two-particle amplitudes can be modified to give the correct theory for bound states, but this is not the case for more than two particles. It is thought that this theory can be generalized to a formulation of relativistic quantum mechanics of interacting particles. (auth)

11119 HOLISTIC ELECTRON THEORY. Cohn, J. (Oklahoma Univ., Norman). Int. J. Theor. Phys.; 9: No. 3, 179-184 (Mar 1974).

A relativistic, nonquantum theory of electrons is constructed in which the electron is not considered to be composed of any type of distribution of charge. The electron's structurelessness is defined by several assumptions which, together with Maxwell's equations outside the electron, yield the general fields produced by such an arbitrarily moving holistic electron. Several equations of motion for the holistic electron are found to result from the formulation, the Lorentz-Dirac equation being among them. The formulation, by its very nature, avoids the problems of the electron self-energy and the need for normalization. (auth)

11120 FORM OF THE CASCADE CURVES FOR SANDWICH ABSORBERS. Kol'chuzhkin, A. M.; Ryzhov, V. V.; Shoshin, E. B.; Pushkin, A. V.; Kondratenko, N. G. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 146-147(1973). (In Russian).

The cascade curves were calculated for absorbers consisting of acryl and Pb, Pb, Pb and Cu, and Pb and Al. The curve for acryl and Pb shows that in the acryl layer the curve has a minimum caused by the transition effect. For the other absorbers it is seen that the cascade curves are not symmetric within the layers and have a minimum close to the second boundary. This agrees with experimental data. (JSR)

11121 ONE APPLICATION OF THE LORENTZ TRANSFORMATIONS FOR THE SPECTRAL-ANGULAR DISTRIBUTION OF A CHARGE RADIATION. Bagrov, V. G.; Bordovitsyn, V. A.; Korytov, G. F. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 144-145(1973). (In Russian).

The Lorentz transformation method is used for the study of the spectral-angular distribution of a charge radiation moving along a flat trajectory in homogeneous and orthogonal electromagnetic fields if the distribution of the radiation in the reference system with a purely magnetic field is known. (JSR)

11122 RADIATION OF A CHARGE IN NONHOMOGENEOUS ORTHOGONAL ELECTROMAGNETIC FIELDS. Bagrov, V. G.; Bordovitsyn, V. A.; Epp, V. Ya. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 101-107(1973). (In Russian).

By the methods of classical electrodynamics it was shown that under given conditions in random nonhomogeneous orthogonal fields, depending on two Cartesian coordinates, harmonic motion of a charge along a flat trajectory can occur. The radiation of the charge had specific characteristics which are explained by the size and character of the nonhomogeneous external fields in the region of the trajectory. (tr-auth)

11123 CAUSALITY VIOLATION IN DEEP INELASTIC ELECTRON–PROTON SCATTERING. Sekine, M. (Univ., Konstanz, Ger.). Progr. Theor. Phys. (Kyoto); 51: No. 1, 242-248(Jan 1974).

As an alternative to the famous Bjorken scaling, the concept of causality violation is introduced into the inelastic structure functions at small q^2. It is assumed that causality is violated in the vicinity of the vertex of the light cone. The result agrees with a recent experiment and shows that causality might be violated at distances of the order of 10^{-14} cm. (auth)

11124 MEASURING ANOMALOUS DIMENSIONS AT HIGH ENERGIES. Carlitz, R.; Tung, W. (The Enrico Fermi Institute and the Department of Physics, The University of Chicago, Chicago, Illinois 60637). Phys. Rev. D 9: No. 1, 306-310 (1 Jan 1974).

A search for operators with anomalous dimensions is crucial in resolving the conflict of the light-cone algebra hypothesis with the results of explicit calculations in interacting field theories. A likely place to find evidence for anomalous dimensions is in the large-ω region of high-energy inelastic eN and μN scattering. (auth)

11125 ρ^0 SHAPE IN PHOTOPRODUCTION. Spital, R.; Yennie, D.R. (Laboratory of Nuclear Studies, Cornell University, Ithaca, New York 14850). Phys. Rev. D 9: No. 1, 126-137 (1 Jan 1974).

The theoretical and practical difficulties involved in extracting ρ^0-photoproduction cross sections from measured dipion mass distributions are discussed. To circumvent the theoretical ambiguities, a standard definition of the ρ^0 cross section is suggested. The definition requires that the mass and width of the ρ^0 be externally specified; however, we have also attempted to analyze the data to determine these parameters. Because of the theoretical ambiguities, it is not feasible to determine the mass and width from individual curves, and even a simultaneous fit of all the curves gives results which depend on the assumed fitting function. Thus the width has a theoretical ambiguity of order 15 MeV in addition to any statistical uncertainty. (auth)

11126 OPTICAL-MODEL ANALYSIS OF TWO ρ^0-PHOTOPRODUCTION EXPERIMENTS. Spital, R.; Yennie, D.R. (Laboratory of Nuclear Studies, Cornell University, Ithaca, New York 14850). Phys. Rev. D 9: No. 1, 138-155 (1 Jan 1974).

An optical-model analysis of two important experiments measuring ρ^0 photoproduction on complex nuclei is presented. In an effort to determine σ_ρ, the ρ^0-nucleon total cross section, and α_ρ, the ratio of the real to the imaginary part of the ρ^0-nucleon forward elastic scattering amplitude, the best normalization of the theory to the experimental data is determined for many pairs of values of these parameters. It is concluded that uncertainties in the theory make it impossible to determine σ_ρ and α_ρ uniquely, but that if one is taken as known, the other can be determined well; and the two experiments give approximately the same relationship between σ_ρ and α_ρ. If α_ρ is taken to be $\simeq -0.2$, $\sigma_\rho \simeq 27$ mb is obtained, consistent with older analyses. Some attention is also focused on $\frac{d\sigma}{dt}|_0$, the forward differential cross section for ρ^0 photoproduction on one nucleon, and the closely related parameter $\gamma_\rho^2/4\pi$. These quantities are somewhat uncertain, however, because of theoretical ambiguities in determining the normalization of the experimental cross sections. Various uncertainties in the optical model are discussed, and it is concluded that they may make small numerical changes in the results but do not affect the qualitative picture. (auth)

11127 QUARK-PARTON FRAGMENTATION FUNCTIONS. Cleymans, J. (III. Physikalisches Institut, Technische Hochschule, Jagerstrasse, Aachen, Germany (F.R.)); Rodenberg, R. Phys. Rev. D 9: No. 1, 155-158 (1 Jan 1974).

The distributions of π^+ and π^- produced in the current fragmentation region are analysed in the framework of the quark-parton model. Motivated by experimental results on deep-inelastic neutrino scattering, we have neglected antiquark (and strange quark) contributions whenever the Bjorken scaling variable x is not close to zero. This approximation enables us to extract the quark fragmentation functions $D^{\pi^+}_u(z)$ and $D^{\pi^+}_d(z)$. The π^+/π^- asymmetry is then calculated as a function of Q^2. This tests the factorization properties of the quark-parton model as a whole range of x values is involved. Agreement with existing data is found. Predictions for future experiments are also presented. (auth)

11128 NEUTRON-PROTON FORM FACTORS. II. Hammer, C.L.; Weber, T.A.; Zidell, V.S. (Ames Laboratory-USAEC and Department of Physics, Iowa State University, Ames, Iowa 50010). Phys. Rev. D 9: No. 1, 158-167 (1 Jan 1974).

In a recent letter we suggested that the momentum dependence of the exact meson propagator may be responsible for the dipole-like behavior of the nucleon electromagnetic form factors over the limited range of data available. In this paper we extend the analysis to include more than one vector-meson propagator, and, by assuming a simplified form for the imaginary part of the level shift, we calculate the form factors explicitly. The nucleon electromagnetic form-factor data are fitted for momentum transfer to 2 GeV/c assuming just one isovector-vector meson and two isoscalar-vector mesons. The resulting fit is much better than that obtained using the dipole formula, and min χ^2 occurs for values of the masses and widths of the vector mesons close to the experimental values of the ρ, ω, and ϕ resonances. The six independent meson-nucleon coupling constants are determined. Their values are consistent with the assumption that the nuclear charge and the magnetic moment distributions are extended, that is, that there are no hard-core contributions to the form factors. This assumption completely determines the isovector coupling constants and reduces the number of independent coupling constants to two. The pion and kaon charge form factors, as deduced from the nucleon charge form factors assuming universality, are compared with the available data. The pion form factors fit the data in both the spacelike and the timelike regions, including the resonance shape for the ρ contribution to the pion form factor. The kaon form-factor data disagree with the assumption of universality in both the spacelike and the timelike regions. (auth)

11129 Z^0 PHOTOPRODUCTION AT HIGH ENERGY. Cahalan, R.F. (Physics Department, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). Phys. Rev. D 9: No. 1, 257-272 (1 Jan 1974).

We study the photoproduction of the so-called Z^0, conjectured in certain theories of the weak interactions, in the limit of incident photon energy much larger than the Z^0 mass and the momentum transfer to the target. The incident photon creates a lepton-antilepton pair which exchanges photons with the target before combining to form the Z^0. The Z^0 generally has both charge conjugation $+1$ and -1, so we study both one- and two-photon exchange. The latter is essentially a generalization of Delbrück scattering. The amplitudes are complex due to the leptonic decay of the Z^0. If the unknown couplings are not much bigger than the electric charge, then our quantitative results will be extremely small due to the large Z^0 mass, even in the limit of infinite energy. We also sum over all exchanged photons, obtaining a well-known form for the amplitude, which may merit further study in the context of photoproduction. (auth)

11130 HEAVISIDE-MALLET RADIATION. Jelley, J. V. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Nature (London); 247: No. 5440, 401(8 Feb 1974).

Comments are offered on Kaiser's communication concerning "Heaviside" radiation (Nature 247:400 (1974)). It is stated that Heaviside did not suggest or carry out any experimental work—this indeed was virtually impossible at the time. It was on the theoretical side that Heaviside's work is significant, and it is considered that his name should thus be linked with those of Vavilov and Frank and Tamm. So far as the experimental side is concerned it is thought that credit should be given to Mallet who, through his observations between 1926 and 1928, was probably the first to study the effect usually attributed to Cherenkov. It is suggested that the title "Heaviside-Mallet radiation" might be more appropriate. It is noted that there is little doubt that the glow from the concentrated radioactive solutions prepared by Mme Curie was generated by the same mechanism. Great credit should, however, be given to the Russians. (UK)

11131 GAUGE MODEL OF WEAK AND ELECTROMAGNETIC INTERACTIONS WITH THE RULE $\Delta T = \frac{1}{2}$ FOR NONLEPTONIC DECAYS OF HADRONS. Ivanov, A. N. (Leningrad State Univ.). Yadern. Fiz.; 19: No. 5, 1081-1092(May 1974). (In Russian).

The gauge invariant theory of weak and electromagnetic interactions with the symmetry group $SU_2 \times U_1 \times U_1$ is used to construct a model hadrons in which the rule $\Delta T = \frac{1}{2}$ is valid for nonleptonic decays with variation of strangeness. Hadrons are the multiplets of the ordinary quarks p, n and λ. The strong interactions between quarks are absent. The hadronic scheme of weak and electromagnetic interactions is also expanded to leptons. The scheme involves the observed particles ν_e, e^-, ν_μ and μ^- as well as new heavy leptons. These particles are necessary in order to avoid the contradiction with the data on the leptonic decays of hadrons. The predictions made by the model for pure leptonic processes as $\bar{\nu}_e + e^- \to \bar{\nu}_e + e^-$ coincide with the V-A theory. (auth)

11132 ASSOCIATED PHOTOPRODUCTION OF THE $\Delta(1236)$ ISOBAR AND VECTOR MESONS AT HIGH ENERGIES. Zhamkochyan, V. M.; Matinyan, S. G.; Shakhnazaryan, Yu. G. (Erevan Physical Inst.). Yadern. Fiz.; 19: No. 5, 1093-1097(May 1974). (In Russian).

Production of the $\Delta(1236)$ isobar and neutral vector mesons in the reaction $\gamma + N \to V^0 + \Delta$ is considered on basis of the absorption model. The momentum-transfer dependence of the angular distribution and of the asymmetries Σ and P_0 are obtained, as well as the γ-energy dependence of the total cross section. (auth)

11133 INFRARED ASYMPTOTICS OF THE GREEN FUNCTION. Pron'ko, G. P.; Solov'ev, L. D. (Inst. of High Energy Physics, Serpukhov, USSR). Teor. Mat. Fiz.; 19: No. 2, 172-185(May 1974). (In Russian).

In the framework of the axiomatic approach all the model-independent terms in the infrared asymptotics of the Green function for the charged scalar particle are found out. (auth)

11134 QUASIASYMPTOTICS OF GENERALIZED FUNCTIONS AND THE AUTOMODELITY OF ELECTROMAGNETIC FORM FACTORS. Zav'yalov, B. I. (Inst. of Mathematics, Moscow). Teor. Mat. Fiz.; 19: No. 2, 163-171(May 1974). (In Russian).

It is shown that the sufficient conditions of the automodel behavior of electromagnetic form factors, which require the existence of quasiasymptotics of the spectral densities, are at the same time necessary ones. (auth)

11135 INDUCED RADIATION OF NEUTRAL FERMI PARTICLES MOVING IN THE EXTERNAL ELECTROMAGNETIC FIELD. Klimenko, Yu. I.; Pavlova, O. S.; Khudomyasov, A. I. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 14: No. 6, 635-641 (1973). (In Russian).

The induced radiation of neutral Fermi particles having an abnormal magnetic moment in a wave field and in constant orthogonal magnetic and electric fields of different magnitude was studied. The effect of polarization of the waves on the radiation intensity was studied. The spin effects were examined and it was shown that as a result of the radiation the particle spin can acquire a preferential orientation. (tr-auth)

11136 CHANGES IN CHERENKOV RADIATION INDUCED BY AN EXTERNAL FIELD. Musakhanyan, V. V.; Nikishov, A. I. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 4, 1258-1268(Apr 1974). (In Russian).

Earlier it was suggested that the Cherenkov radiation spectrum can be changed easily by moderate external fields. This problem is analyzed. From general considerations and also on basis of two examples (electron motion in medium along a spiral and in the field of a plane electromagnetic wave) it is shown that the effect of the field on the Cherenkov radiation spectrum decreases with the increase of particle energy and even for nonultrarelativistic particles very strong fields are necessary in order to significantly change the radiation spectrum, if the intensity of Cherenkov radiation is not too small. (auth)

11137 POLARIZATION STABILITY OF OPPOSITE-MOVING BEAMS. Kondratenko, A. M. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 66: No. 4, 1211-1218 (Apr 1974). (In Russian).

The depolarizing effect of an oppositely moving beam on the polarization of particles in storage elements due to stochastic mixing of the particle trajectories in an external field (e.g. as that due to quantum fluctuations of synchrotron radiation) is studied. In particular a restriction on the maximal number of opposite-moving particles which do not destroy the radiative polarization of the beam is obtained for an electron (positron) beam. (auth)

11138 GREISEN APPROXIMATION FOR THE LONGITUDINAL DEVELOPMENT OF NUCLEAR CASCADES. Sitte, K. Atti Accad. Sci. Torino. I. Cl. Sci. Fis., Mat. Natur.; 107: No. 3, 335-340(1973).

An approximation for the longitudinal development of nuclear cascades in air is obtained by adaptation of the parameters of Greisen's relation. It is shown that the new expression describes well the experimental data both on the altitude variation of the shower size, and on the size distribution at sea level and at mountain altitude. (auth)

Weak

11139 (FAI-16) BINARY NEUTRINO PROCESSES AND THE COUPLINGS WITH DERIVATIVES IN THE MUON CURRENT. Kutuzova, G. B. (AN Ehstonskoj SSR, Tartu. Inst. Fiziki i Astronomii). 1972. 31p. (In Russian). INIS.

Consideration is given to a model of weak interactions in which at an unchanged V-A structure ($e\nu_e$) of the electron flux a more general expression is used for the ($\mu\nu_\mu$) muon flux, where the derivatives and a small impurity of the V + A structure are included. Estimates of deviations from V-A theory are presented for binary neutrino processes with values of impurities obtained on considering $\mu \to e$ and $\pi \to \mu$ decays. The contribution from coupling with derivatives to the total cross sections of purely leptonic processes is small. For the process $\nu_\mu + e^- \to \nu_e + \mu^-$ the taking into account of new structures leads to an impurity of the P-state. For "elastic" scattering of a neutrino on a nucleon the maximum cross section values are shifted to the side of somewhat larger energies, and are increased by 20 to 25%. (SJR)

11140 (IFVE-SPK-72-88) TOTAL AND DIFFERENTIAL CROSS SECTIONS FOR LEPTON PAIR PRODUCTION IN NEUTRINO PROCESSES WITH ACCOUNT OF NEUTRINO BEAM ENERGY SPECTRUM. Makeev, V. V.; Sokolov, A. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 29p. (In Russian). INIS.

Within the framework of four-fermion, V-A-theory of weak interactions an analysis is presented for the process $\nu_\mu + Z \to \lambda^+ + \mu^- + \nu_e + Z$. A complete analysis is presented for the mechanisms of incoherent, deeply inelastic and coherent generation. It is shown that the coherent mechanism plays the main role. Concrete calculations were made with the energy spectrum of the neutrino being taken into account in the region of energies $E < 70$ GeV. Double differential and total cross sections of the above reaction on nucleons and the nuclei C, F and Br were obtained. (SJR)

11141 (ISS-L-73-13) CHARMED PARTICLES AND HEAVY LEPTONS. Altarelli, G.; Maiani, L. (Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica). 13 Dec 1973. 27p. Dep. NTIS (US Sales Only) $4.50.

Properties of charmed particles and heavy leptons relevant to their experimental search are reviewed and discussed. (Contribution to a study report for the Superadone project). (auth)

11142 (MATSCIENCE-78, pp 150-167) POLARISATION OF NEUTRONS IN HIGH-ENERGY ANTINEUTRINO SCATTERING. Teli, M. T. (Shivaji Univ., Kolhapur, India). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The stokes parameters and degree of polarization of the recoil neutrons in the $\bar{\nu} + p \to l + n$ high energy scattering are discussed for various cases of proton polarization under both the T-invariance and noninvariance conditions. The polarization analysis is also made through the relations between any pair of degrees of polarization which are characteristic of the target polarization and its energy and are independent of the scattering angle and form factors. (auth)

11143 ORTHOGONALITY OF K^0-MESON NONLEPTONIC WEAK-DECAY RESIDUES. Horwitz, L. P.; Mizrachi, L. (Tel-Aviv Univ., Israel). Nuovo Cim.; 21A: No. 4, 625-638(21 Jun 1974).

Using nonperturbative techniques, it is shown that interference terms due to the failure of the exact semi-group behavior of the nonleptonic weak-decay law may be $O(\alpha^3)$, where $\alpha^2 \sim 10^{-3}$, independently of the size of the weak-coupling constant. Consequences of these interference terms for regeneration experiments are calculated. (auth)

11144 WEAK INTERACTIONS AND THE BARYONIC CURRENT. Sakurai, J.J. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. D 9: No. 1, 250-252 (1 Jan 1974).

We conjecture that neutrino scattering probes the baryonic currents of hadrons. A new model of $\Delta S = 0$, $\Delta Q = 0$ semileptonic weak interactions is constructed with numerous experimental consequences. (auth)

11145 TEST OF CABIBBO'S MODEL IN HYPERON SEMILEPTONIC DECAYS. Garcia, A. (Departamento de Física, Centro de Investigación y de Estudios Avanzados, Instituto Politecnico Nacional, Apartado Postal 14-740, México 14, D.F.). Phys. Rev. D 9: No. 1, 177-180 (1 Jan 1974).

The experimental rates and angular correlation and asymmetry coefficients are used to test Cabibbo's model in semileptonic hyperon decays. The data indicate that the one-angle model should be relaxed. We consider the possibility that $\theta_V + \theta_A$, and we investigate the influence of the q^2 dependence of the form factors. We find that the present data are sufficiently accurate to detect symmetry-breaking effects. (auth)

11146 I = 1/2 CONTRIBUTIONS TO $\nu_\mu + N \to \nu_\mu + N + \pi^0$ IN THE WEINBERG WEAK-INTERACTION MODEL. Adler, S.L. (Institute for Advanced Study, Princeton, New Jersey 08540). Phys. Rev. D 9: No. 1, 229-230 (1 Jan 1974).

We use a detailed dispersion-theoretic model for pion production in the (3, 3) -resonance region to calculate the ratio $R=[\sigma(\nu_\mu + n \to \nu_\mu + n + \pi^0) + \sigma(\nu_\mu + p \to \nu_\mu + p + \pi^0)]/2\sigma(\nu_\mu + n \to \mu^- + p + \pi^0)$ in the Weinberg weak-interaction theory. We find that I=1/2 contributions do not substantially modify the earlier static model calculation of R given by B. W. Lee. (auth)

11147 TESTS OF CHARGE SYMMETRY AND SCALING IN NEUTRINO PHYSICS. De Rújula, A.; Glashow, S.L. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. D 9: No. 1, 180-184 (1 Jan 1974).

Recent theories of weak interactions require a weak current which strongly violates the usual charge-symmetry requirement. We explore the consequences of this fact for deep-inelastic neutrino and antineutrino scattering assuming the validity of Bjorken scaling. (auth)

11148 RADIATIVE CORRECTION TO μ DECAY. Malyshkin, V. G. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 19: No. 5, 1071-1074(May 1974). (In Russian).

The radiative corrections to the decay spectrum of the polarized μ meson are considered. The parts of the radiative corrections leading to the infrared divergences are summed in all orders over the fine structure constant α. All other contributions were calculated in the first order. The electron mass was not neglected, therefore the spectrum has no singularities at both tails. The calculations are made for the case when the vector and axial coupling constants are not equal. (auth)

11149 SEMI-LEPTONIC AND NONLEPTONIC PROCESSES IN THE NONPOLYNOMIAL MODEL OF WEAK INTERACTIONS. Abdullaev, F. Kh. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 19: No. 5, 1075-1080(May 1974). (In Russian).

The methods of the nonpolynomial Lagrange field theory are used to study the four-fermion weak interactions of the highest order in the framework of the "strong gravity" model for nonlinear universal coupling of hadrons and f meson. The amplitude of the neutrino-nucleon elastic scattering and the mass difference $K_L^0 - K_S^0$ are calculated as well as the weak interaction corrections to the nucleon masses; i.e. those processes were studied about which the conclusion is often made that the usual form of weak interactions is inapplicable at high energies. The calculation results are in satisfactory agreement with the data at the value of the massive gravitation coupling constant $k_f^{-1} \sim (2-3)\ M_{nucl}$. (auth)

11150 VIOLATION OF THE ΔI ABSOLUTE VALUE = $\frac{1}{2}$ RULE IN $K \rightarrow 3\pi$ DECAYS. Kudo, K. (Hiroshima Univ.); Ohya, K.; Oka, T. Progr. Theor. Phys. (Kyoto); 50: No. 6, 1973-1980 (Dec 1973).

The violation of the $|\Delta I| = \frac{1}{2}$ rule in $K \rightarrow 3\pi$ decays is discussed on the assumption that the weak-interaction Hamiltonian has the pure $|\Delta I| = \frac{1}{2}$ property and that the violation of the $|\Delta I| = \frac{1}{2}$ rule is caused by the electromagnetic interaction. The assumptions of chiral $SU_3 \times SU_3$ algebra, P. C. A. C. and soft pion approximation are also used. The results are in good agreement with experiments. (auth)

11151 THEORY OF PRECESSION OF μ^--MESON POLARIZATION VECTOR IN MUNUCLEONIC ATOMS. Gorelkin, V. N.; Smilga, V. P. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 4, 1201-1210(Apr 1974). (In Russian).

Precession of a μ^--meson spin in a magnetic field perpendicular to the initial polarization is considered. The munucleonic atom formed after μ^--meson capture in the K orbit and possessing a charge Z-1 may have an electron shell with a total moment j. The cases $j = \frac{1}{2}$ and $J = \frac{3}{2}$ are analyzed in detail. It is pointed out that three spin precession stopping points may be observed. Investigation of these precession stopping points may be of great interest, in particular, as a possible precision method for investigation of hyperfine structure. It is suggested that analysis of μ^--meson spin precession may be employed for investigation of the hyperfine structure of acceptor impurity levels. The nature of the precession pattern expected and the possibilities of the method are analyzed. It is noted that the scale of the hyperfine splitting field in "quasimuonium" produced on capture of μ^--mesons in semiconductors is from 10 to 100 times smaller than that in muonium; moreover, fields of the order of 10^2 to 10^3 G are sufficient for observation of effects in "quasimuonium" whereas ultrastrong fields of the order of 10^5 to 10^6 G (precession stopping) are required for muonium. It is mentioned that the method proposed can be employed for measuring the hole spin relaxation time and to elucidate the tensor character of the hyperfine splitting. (auth)

Strong (General)

Refer also to abstracts 11001 and 11756.

11152 (CONF-720737-) PROCEEDINGS OF THE 1972 KEK SUMMER SCHOOL, NATIONAL LABORATORY FOR HIGH ENERGY PHYSICS, IBARAKI, JAPAN, JULY 17-21, 1972. Kawaguchi, M.; Takahashi, K. (eds.). (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Dec 1972. 314p.

The conference included six lectures. Separate abstracts were prepared for each lecture. (JFP)

For abstracts of individual lectures see: 9627, 10987, 11038, and 11153-11155.

11153 (CONF-720737-, pp 113-161) STRONG INTERACTION AT HIGH ENERGY. Sugawara, H. (Tokyo Univ.). Dec 1972.

From proceedings of the 1972 KEK summer school; Ibaraki, Japan (17 Jul 1972).

The present status of hadronic interactions at high energies is discussed. The general picture of the hadron collision and the inelastic collision are considered. (JFP)

11154 (CONF-720737-, pp 255-270) COMPOSITE STRUCTURE OF HADRONS AND TWO-BODY REACTIONS. Matsuoka, T. (Nagoya Univ., Japan). Dec 1972.

From proceedings of the 1972 KEK summer school; Ibaraki, Japan (17 Jul 1972).

The t-channel exchange objects in high energy amplitudes and the involvement in the structure of the amplitudes, the breaking of line-reversal relations, and D/F ratios of the amplitudes are discussed. Also covered are the counting of urbaryon rearrangements. (JFP)

11155 (CONF-720737-, pp 271-312) PHENOMENOLOGY OF HADRONIC INTERACTIONS AT INTERMEDIATE ENERGIES. Fukugita, M. (Tokyo Univ.). Dec 1972.

From proceedings of the 1972 KEK summer school; Ibaraki, Japan (17 Jul 1972).

Attention is focused on the resonant part of the amplitude which is considered to build the ordinary Regge exchange. The results of the analyses are presented by making use of partial wave data, and their implications for the model of hadronic reactions at higher energy are discussed. (JFP)

11156 (COO-3533-30) LECTURES ON DUAL RESONANCE MODELS. Part Six. Symmetric Group. Frampton, P. H. (Syracuse Univ., N. Y. (USA). Dept. of Physics). 1974. Contract AT(11-1)-3533. 56p. (SU-4205-30). Dep. NTIS $6.00.

Lectures are given on the problem of changing the Regge intercepts to realistic values for dual resonance models. (JFP)

11157 (JINR-P2-7752) CORRELATIONS OF NEUTRAL AND CHARGED PARTICLES IN π^-N-COLLISIONS AT P = 40 GeV/c. Amaglobeli, N. S.; Mitryushkin, V. K.; Sissakian, A. N.; Tsivtsivadze, E. T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A generalization of the model of multiparticle production in hadron-hadron interactions at high energies is performed for the case when strange particles are present. The main concepts of this model follow from the coherent state model and the straight-line paths approximation. The model proceeds from the following statements: existence of the leading particles and possibly their dissociation with local preservation of quantum number; uncorrelated production of hadron groups in the central regions by the Poisson law. These groups then decay into pions and kaons. The mean numbers of these hadron groups do not depend on the type of colliding particles at high energies. The model predicts the superposition of Poisson functions for distribution of charged particles, the presence of strong correlation between K^+-and K^--, K^o-and $\bar{K}^o$ - mesons and suggests the dependence of average number of K^o, Λ^o and Σ^o on the number of charged particles. This dependence for π^-p - collision is the constant value, and so does for π^-N -collision but for sufficiently large numbers of charged particles. Comparison of the model with the data on π^-p and π^-N -interactions from experiments carried out at Serpukhov on a two-meter propane chamber at the negative pion momenta p = 40 GeV/c gives good agreement. (auth)

11158 (RL-74-50) SOLVABLE ONE DIMENSIONAL MODELS OF PARTICLE PRODUCTION. Peccei, R. D. (Science Research Council, Chilton (UK). Rutherford High Energy Lab.). Apr 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

A variety of simple one-dimensional models for particle production are discussed. For each of these models a closed form for the generating functional is derived which allows one to calculate the totality of inclusive, semi-inclusive and exclusive distributions. The models discussed include an n-trajectory multiperipheral model and a general cluster model. In this latter model a parameter independent relation between semi-inclusive and inclusive cross sections is derived. (auth)

11159 ON THE UNIQUENESS OF THE SMOOTH ZERO MASS LIMIT FOR INVARIANT AMPLITUDES. Kellett, B.H. (Department of Natural Philosophy, University of Glasgow, Glasgow G12 8QQ, Scotland). Ann. Phys. (N.Y.) 83: No. 1, 169-185 (Mar 1974).

The behavior of the invariant amplitudes for processes involving massive vector mesons is investigated in the limit as the mass goes to zero. The constraints of gauge invariance impose a definite structure on the amplitudes at $k^2=0$, and the question of the uniqueness of this structure is examined. It is shown that if the limit is smooth, the consequent relations between the massive and massless helicity amplitudes are unique, provided only that any additional dynamical assumptions are made consistently. Some of the implications of this result are discussed, with particular reference to the unambiguous

covariant formulation of vector meson dominance for scattering amplitudes. (auth)

11160 OPTICAL MODEL OF STRONG INTERACTIONS AND EIKONAL APPROXIMATION IN SCATTERING THEORY. Barbashov, B. M.; Blokhintsev, D. L; Nesterenko, V. V.; Pervushin, V. N. (Joint Institute for Nuclear Research, Dubna). Sov. J. Particles Nucl.; 4: No. 3, 261-276(Jan 1974).

The optical model of strong interactions and semiclassical and eikonal approximations in potential scattering, the spin and anomalous magnetic moment of interacting particles being taken into account, are considered. The possibility of deriving the eikonal formulas which are proposed for the phenomenological description of the high-energy hadron scattering is discussed in the framework of quantum field theory. (auth)

11161 $p\bar{p}$ ANNIHILATIONS AND THE CHARACTER OF MULTIPARTICLE PHASES. Teper, M. (Westfield Coll., London). Lett. Nuovo Cim.; 10: No. 5, 185-188(1 Jun 1974).

It is shown that simple uncorrelated phases will not reproduce the experimentally determined overlap function of $p\bar{p}$ annihilations. It is concluded that one cannot claim a strong correlation between the shape of the elastic forward peak and the form of the jet structure of multiparticle processes. (LBS)

11162 APPLICATION TO A SEQUENTIAL DECAY SCHEME FOR MULTIPARTICLE PHENOMENA. Ballestrero, A. (Instituto Nazionale di Fisica Nucleare, Turin). Nuovo Cim.; 21A: No. 3, 503-517(1 Jun 1974).

The formalism previously developed for multiparticle production phenomena is applied to a specific choice of energy distribution probability which is guessed from inclusive one-particle data. The asymptotic picture that emerges is in rather nice qualitative agreement with the experimental trend. (auth)

11163 SEQUENTIAL DECAY APPROACH TO MULTIPLE PRODUCTION. Ballestrero, A.; Predazzi, E. (Univ., Turin). Nuovo Cim.; 21A: No. 3, 485-502(1 Jun 1974).

A model is proposed in which multiparticle decay occurs through a sequential rate of one particle at a time. Energy and charge are conserved at each step and probability conservation follows. The mathematical study of the model can be formulated by means of Volterra integral equations. (auth)

11164 NOVA MODEL FOR DIFFRACTION DISSOCIATION WITH LONGITUDINALLY DECAYING NOVAS. Kanjantie, K. (Univ. of Helsinki); Ruuskanen, P. V. pp 515-533 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Than Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

A model for diffractive events in high energy hadron collisions is constructed and the charged particle multiplicity distribution following from this is calculated. The model is a nova-type model in which the excitation spectrum of the nova behaves like M^{-2} for large M and in which the nova decays longitudinally in its rest frame. These features are motivated by simple multiperipheral arguments. Implications of the results on multiperipheral and uncorrelated jet model descriptions of the pionization component are discussed. (auth)

11165 DUALITY IN REGGEON–PARTICLE SCATTERING. Roy, D. P. (Science Research Council, Chilton, Eng.). pp 499-514 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Than Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The Dolen–Horn–Schmid type duality ansatz is extended to the Reggeon-particle amplitude which is directly related to the inclusive cross section in the resonance region $M^2 \ll s$. The ansatz relates the resonance production cross section to the resonance mass in terms of the exchanged trajectory α. These duality relations agree remarkably with a large number of resonance production data. (auth)

11166 UPPER BOUND ON MULTIPLICITY MOMENTS FROM GENERAL MULTIPERIPHERAL DYNAMICS. Bassetto, A. (Univ., Padua); Buras, A. J. Lett. Nuovo Cim.; 10: No. 3, 73-77 (18 May 1974).

An upper bound on the binomial multiplicity moments for the n-particle production is derived. The extent to which experimental data on pp interactions at 205 GeV/c, 405 GeV/c, and 10^4 GeV/c confirm the multiperipheral upper bound is examined. It is suggested that the bound can be easily used to distinguish between production models which belong to the general multiperipheral scheme and those which are outside this scheme. (LBS)

11167 TRACING PARTONS IN HADRON COLLISIONS AT HIGH TRANSVERSE MOMENTUM. Halzen, Francis. (Univ. of Wisconsin, Madison). pp 289-317 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

Hadron collisions at large transverse momentum are discussed. They probe the hadrons at small distances. The phenomenological analysis of two body reactions at large angles and single particle inclusive reactions at large p_T are discussed together with jets of large transverse momentum hadrons. (auth).

11168 IMPACT PICTURE FOR STRONG INTERACTIONS. Walker, J. K. (National Accelerator Lab., Batavia, IL). pp 159-192 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

A brief discussion of the general characteristics of the impact picture is given. This leads to a description of a phenomenological model of hadron scattering which on the one hand satisfies the impact picture at extremely high energies and on the other successfully describes the data above 20 GeV in the laboratory. In addition, many predictions on the general behavior of high energy hadron–hadron interactions are given. (auth)

11169 PERIPHERISM, ABSORPTION, AND DUALITY. Volume 1. Summer School on Particle Physics, Gif-sur-Yvette, France, September 4, 1972. Cohen-Tannoudji, G.; Girardi, G.; Hayot, F.; Lacaze, R.; Morel, A.; Peschanski, R. Paris; Institut National de Physique Nucleaire et de Physique des Particules (1972). 149p. (In French).

The various models used to study the scattering of hadrons are discussed: description in terms of resonances; geometrical description (diffraction peripherism); description in terms of exchanges (Regge poles). The dual models explaining the identity between these different points of view are then studied, some specific references being made to the Regge pole model. (auth)

11170 SIZE OF POLARIZATION IN INCLUSIVE PROCESSES. Soffer, J. (CERN, Geneva); Wray, D. Nucl. Phys.; B73: No. 2, 231-236(1974).

Polarization in inclusive processes in the beam fragmentation region is studied in the framework of a simple Regge-cut model. Predictions are obtained for the dependence on the kinematic variables, and the magnitude of polarization is estimated. (auth)

11171 DUAL M-MODELS. Bardakci, K.; Halpern, M. B. (Univ. of California, Berkeley). Nucl. Phys.; B73: No. 2, 295-313 (1974).

Following carefully the guidelines of the M-hadron models in gauge Lagrangian theory, their dual counterparts are constructed. The recent effective Lagrangian approach to spontaneous breakdown indicates that these models may provide physically reasonable dual models of hadrons, including raised vector-meson masses and $(3,\bar{3})$-broken chiral SU(3). (auth)

11172 STRONG INTERACTION PHYSICS. International Summer Institute on Theoretical Physics, Kaiserslautern, Germany, July 17–28, 1972. Ruehl, W.; Vancura, A. (eds.). Lecture Notes in Physics, Volume 17. New York; Springer-Verlag, New York, Inc. (1973). 411p. (CONF-720738-). $10.80.

The publication contains 16 lectures. Separate abstracts were prepared for each lecture. (JFP)

For abstracts of individual lectures see: 11007, 11068, 11069, 11114, 11173, 11174, 11216, 11266–11268, 11727, and 11756–11760.

11173 OPTIMIZATION OF COLLISION AMPLITUDES UNDER CONSTRAINTS. Eden, E. J. (Cevendish Lab., Cambridge, Eng). pp 43-60 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

Lectures are given on optimization under constraints for collision amplitudes at asymptotic and finite energies. Integral constraints are included. (JFP)

11174 PHENOMENOLOGICAL STUDY OF TWO-BODY HADRON SCATTERING. Kane, G. L. (Univ. of Michigan, Ann Arbor). pp 106-145 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

Lectures are given on the present structure of the experimental data and recent attempts to describe it, the presentation of a realistic absorption model for two-body reactions above the resonance region, and the view of duality and exchange degeneracy from a phenomenological point of view rather than a theoretical one. (JFP)

11175 STUDY OF THE $\pi^+\pi^-\pi$ SYSTEM IN THE DELTA-MESON MASS REGION IN THE NUCLEAR INTERACTION $\pi^-p \rightarrow$ DELTA$^-$p. Upadhyay, P. N. (Gaya Coll., India). Indian J. Pure Appl. Phys.; 11: No. 12, 931-932(Dec 1973).

Results of an analysis of the $\pi^+\pi^-\pi^-$ system in the δ-mass region produced just above the production threshold in $\pi^-p \rightarrow \delta^-p$ with $\delta^- \rightarrow \pi^+\pi^-\pi^-$ are presented. No significant enhancement near the δ^- mass region is found over the four-momentum transfer-squared region from -0.38 to -0.79 $(GeV/c)^2$. (auth)

11176 MODELS FOR LEFT-RIGHT MULTIPLICITIES. Sivers, D. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305); Thomas, G.H. Phys. Rev. D 9: No. 1, 208-228 (1 Jan 1974).

In the context of various models for production processes, we examine what can be learned from data on the number of charged particles per event in the left and right c.m. hemispheres, left-right multiplicity distributions. The appropriate generating-functional formalism is developed. We make explicit calculations of the generating function in both the multiperipheral and Mueller-Regge approaches. We explain how left-right multiplicity distributions are used to separate the components of a hybrid (diffraction plus short-range-order) model. Questions concerning the factorization of the leading Regge singularity are also discussed. (auth)

11177 INCLUSIVE DECAY AMPLITUDES. Horn, D. (National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. D 9:

An inclusive decay amplitude is defined and discussed. It can be understood as a continuation of an absorptive part of $2 \rightarrow 2$ scattering which is related in a different kinematical region to a total cross section. In exotic channels we employ an assumption of smooth behavior of this amplitude to obtain a relation between the width of a resonance and total cross sections. Some examples are discussed. (auth)

11178 KOBA-NIELSEN-OLESEN SCALING AND EIKONAL (TOWER-GRAPH) APPROXIMATIONS. Fried, H.M.; Tan, C. (Department) of Physics, Brown University, Providence, Rhode Island 02912). Phys. Rev. D 9: No. 1, 314-316 (1 Jan 1974).

A prediction of the possible failure of Koba-Nielsen-Olesen (KNO) scaling at CERN ISR energies is given on the basis of the eikonal tower-graph approximation. For high multiplicities, the simplest Cheng-Wu impact-parameter forms yield approximate KNO scaling quantities in agreement with the NAL data. A formula for the calculation of all inclusive moments, from the knowledge of the elastic absorptive eikonal, is written for a wide class of dynamical approximations, of which the simplest is the tower-graph eikonal approximation. (auth)

11179 MAXIMUM-RAPIDITY-GAP DISTRIBUTION. Jones, S.T.; Snider, D.R. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. D 9: No. 1, 242-249 (1 Jan 1974).

We examine the maximum-rapidity-gap distribution as a proposed means of determining the amount of diffractive dissociation (d.d.) (Pomeron exchange) in the data. We find that a clear measurement of d.d. is not possible but that the distribution does separate into two regions where either the diffractive or nondiffractive mechanism dominates. This separation occurs at $\Delta \simeq 4.0$. (auth)

11180 PERIPHERALITY OF TENSOR AND VECTOR EXCHANGES IN AN APPROXIMATELY UNITARIZED DUAL $\pi\pi$ MODEL. II. Balázs, L.A.P. (Department of Physics, Purdue University, Lafayette, Indiana 47907). Phys. Rev. D 9: No. 1, 237-241 (1 Jan 1974).

We consider a simple $\pi\pi$ model in which we first dynamically generate a low- and intermediate-energy absorptive part A and then calculate effective Regge residues in terms of A via finite-energy sum rules (FESR). In an earlier paper, A was calculated by unitarizing the Lovelace-Veneziano model. In the present paper we follow a somewhat less model-dependent procedure. In states and energy regions where no important narrow resonances are present, we evaluate the (background) A by using approximate unitarity and the duality assumption that amplitudes are well approximated on the average by Regge exchange. Elsewhere the resonances (ρ and f^0) are put in by hand. Pomeranchuk (P) parameters are taken from experiment or calculated from simple models. Exchange degeneracy and two-component duality are not assumed a priori, although we find that exchange degeneracy is approximately satisfied by our output Regge residues at $t = 0$. For $t \neq 0$, on the other hand, we find that it is broken. Specifically, ρ exchange is peripheral, as required by the dual absorptive model, whereas f exchange is not; a similar conclusion was reached on purely phenomenological grounds by Barger, Geer, and Halzen for other reactions. (auth)

11181 THEORY OF RELATIVISTIC STRING AND SUPER-WAVE EQUATION. I. Takabayasi, T. (Nagoya Univ., Japan). Progr. Theor. Phys. (Kyoto); 51: No. 1, 262-283(Jan 1974).

The theory of the relativistic string, taken as a model of hadrons, is reconstructed in a general and unifying framework. The classical foundation of the "realistic" string theory is clarified. The theory is derived from the action integral which is invariant under "partial general transformation" on the parameters (σ,τ) for the world sheet traced by a motion of the string, and the fundamental equations are originally covariant under this group. Then by choosing a suitable gauge one obtains a Lorentz-covariant formalism associated with constraints. Its characteristics are analyzed and solutions are obtained. Taking another gauge we get the equivalent "Lorentz noncovariant formalism" free from constraint. This directly exhibits the physical meaning of the theory and also leads to its standard Hamiltonian formalism. Several conservation laws characteristic of the string theory are given. (auth)

Strong (Baryon No. = 0)

11182 (BNL-18918) REVIEW OF STRANGE MESONS. Eisner, R. L. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 31p. (CONF-740408-2). Dep. NTIS $4.75.

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974).

A review of strange meson spectroscopy is presented. The problem areas are still the status of the strange members of the two 1^+ nonets as well as the situation in the high mass K^* region. (auth)

11183 (COO-3071-89) INVESTIGATIONS IN TWO-DIMENSIONAL VECTOR MESON FIELD THEORIES. Segre, G.; Weisberger, W. I. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 18 Mar 1974. 32p. Dep. NTIS $4.75.

Several field theories are studied in one space and one time dimension. Among them are a neutral vector meson with and without mass coupled to fermions and a massive self-coupled Yang-Mills field. For the former methods of solving the field theory are discussed, and for the latter an attempt is made to establish its nonrenormalizability. (auth)

11184 (HU-TFT-73-10) RADIAL EXCITATIONS AND THE RHO'. Raitio, R.; Roos, M. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1973. 10p. INIS.

Using quark-model arguments for the photon-vector meson coupling the ρ' (1600) meson is interpreted as a radial $q\bar{q}$ excitation. The absence of $\pi\pi$ decays is explained by a selection rule for radial de-excitations, applicable also to the $P_{11}(1470)$ baryon state with similar dynamics. The scheme parallels a recent consideration of scale invariance breaking. (auth)

11185 (HU-TFT-74-1) SPECULATIONS ON COMPOSITE QUARKS. Raitio, R. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Jan 1974. 11p. INIS.

A simple field theoretic quark model is proposed in which the quarks are composite. This quark-hadron bootstrap is the new feature of the model. States like $N^*(1470)$ and ρ' (1600) are interpreted as containing quark excitations. Some phenomenological consequences of the model are discussed. (auth)

11186 (JINR-E2-7835) K_S, K_L / MASS DIFFERENCE. Pervushin, V. N.; Volkov, M. K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

The K_S-K_L-meson mass difference is obtained within the framework of chiral quantum field theory.

11187 THE Kπ INTERACTION. Issev, P. S. (Joint Institute for Nuclear Research, Dubna). Sov. J. Particles Nucl.; 4: No. 3, 299-314(Jan 1974).

The principle of extracting the interaction of unstable particles with unstable particles (for instance, $\pi\pi \rightarrow \pi\pi$, $K\pi \rightarrow K\pi$, $K\bar{K} \rightarrow \pi\pi$, from the inelastic interaction processes is described. A review of the world experimental data on Kπ-scattering and $K\bar{K} \rightarrow \pi\pi$-annihilation and a theoretical interpretation of these data by the dispersion relation method and unitarized Veneziano model is given. (auth)

11188 PECULIARITIES OF THE UNSTABLE PARTICLE DESCRIPTION. Papp, E. Stud. Univ. Babes-Bolyai, Ser. Phys.; 18: No. 2, 17-24(1973).

Taking into consideration a two-pole approximation of the S matrix in the momentum plane, the unstable particle lifetime is evaluated as the interaction time of the decay products. The unstable state form factor is then analyzed both when the momentum spectrum is extended only on the positive semi-axis and when it is extended on the whole real axis. In this way, besides new results, relevant peculiarities are reobtained. (JFP)

11189 PAIR PRODUCTION AND QUANTUM NUMBER EXCHANGE IN MULTIPARTICLE PRODUCTION. Petersson, B. (Paris Univ., Orsay, France). pp 553-562 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Than Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The antiproton production was investigated; the analysis is extended to the production of K^-. In particular, in both cases, the rise with energy of the yield and the shape of the rapidity spectra may be explained without free parameters. (auth)

11190 RIGOROUS ABSOLUTE BOUNDS FOR PION–PION SCATTERING. I. Solving a First Extremum Problem. Auberson, G.; Epele, L.; Mahoux, G.; Simao, F. R. A. (CEN de Saclay, Gif-sur-Yvette, France). Nucl. Phys.; B73: No. 2, 314-338(1974).

This paper is the first of a series of three where the derivation of rigorous absolute bounds for strong interactions is considered. It is devoted to the solution of a preliminary extremum problem. From the knowledge, at a given physical energy s and unphysical angle $\cos\theta_0 > 1$, of the absorptive part A ($s, \cos\theta_0$) of the elastic scattering amplitude for two spinless particles, the least upper bound of the modulus $|F(s, \cos\theta_1)|$ of the scattering amplitude for the same energy s and various angles θ_1 is found by exploiting the unitary condition. Upper (but not least upper) bounds given by previous authors are numerically compared with ours. (auth)

11191 $\eta \to 3\pi$ DECAY. Cicogna, G. (Univ., Pisa, Italy); Strocchi, F.; Vergara Caffarelli, R. Lett. Nuovo Cim.; 10: No. 1, 25-27(4 May 1974).

It is pointed out that an accurate model-independent calculation of the $\eta \to 3\pi$ decay rate, without neglecting the SU(3) noninvariance of the vacuum and/or the contributions of subclasses of Feynman diagrams, provides a reasonable solution of the $\eta \to 3\pi$ puzzle with a value of $\epsilon_3 \simeq -0.28\ m_\pi^3$. (LBS)

11192 GREEN'S FUNCTION TECHNIQUES AND DUAL FERMION LOOPS. Fairlie, D. B.; Martin, D. (Univ. of Durham, Eng.). Nuovo Cim.; 21A: No. 4, 647-660(21 Jun 1974).

Using some recent techniques of Mandelstam for the Neveu–Schwarz–Ramond model the momentum-dependent contribution to the one-loop planar and nonplanar amplitudes are calculated, for both fermions and mesons in a unified way and thus one obtains a better understanding of previous results, together with some new results on fermion loops. (auth)

11193 EMPIRICAL REGULARITIES IN 1^+-BOSON MASS SPECTRA AND SCHWINGER MASS RELATION IN CHIRAL DYNAMICS. Natroshvili, K. R.; Khelashvili, A. A. (Tomsk State Univ., USSR). Soobshch. Akad. Nauk Gruz. SSR; 74: No. 1, 65-68(Apr 1974). (In Russian).

Assuming the constancy of the mass ratios of vector- and axial-vector mesons, it is shown that a value, which is well correlated with predictions by the Schwinger formula, is obtained for the mass of the ninth-component of the axial-vector nonet. A model was constructed in which 1^+ boson masses are spontaneously generated. In this model the Schwinger mass formula proves to be in first-order breakdown of vacuum symmetry and, furthermore, constancy of mass ratios of corresponding isomultiplet terms of 1^+ bosons is also realized. (auth)

11194 NN BINDING ENERGIES. Peaslee, D.C. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. D 9: No. 1, 272-274 (1 Jan 1974).

A reported bound state of $\bar{p}n$ at -83 MeV is compared with calculations on the boundary-condition model (BCM) for NN scattering. The most probable orbital assignment for the bound state appears to be $^3S_1$ or $^1P_1$, but it is not possible to distinguish between these two assignments by binding energies alone. At least half a dozen other bound states are predicted. The imaginary part of the core boundary condition is quite small in the present case. Comparison with published calculations using the Bryan–Phillips static (BPS) potential shows that the latter has a somewhat richer spectrum and includes $^3D_1$ as an equally probable orbital for the observed state. The BCM and BPS potentials differ substantially in their spin–isospin dependence, but distinguishing data do not now exist. (auth)

11195 PERIPHERALITY OF TENSOR AND VECTOR EXCHANGES IN AN APPROXIMATELY UNITARIZED DUAL $\pi\pi$ MODEL. I. Balázs, L.A.P. (Department of Physics, Purdue University, Lafayette, Indiana 47907). Phys. Rev. D 9: No. 1, 231-236 (1 Jan 1974).

Recent experimental evidence tends to favor a picture in which vector exchanges (ρ, ω, K^*_{892}) are peripheral, as predicted by the dual absorptive model, whereas tensor exchanges (f^0, A_2, K^*_{1430}) are not. We show that these features arise fairly naturally in $\pi\pi$ scattering if we simply saturate finite-energy sum rules (FESR) with an approximately unitarized Lovelace–Veneziano model. Exchange degeneracy and two-component duality are not assumed a priori for the output effective Regge residues in the FESR, although we find that they are approximately satisfied anyway for $t = 0$. In this calculation, Pomeranchukon parameters are taken from experiment or calculated from simple models. (auth)

11196 SOME RARE MESON-DECAY MODES IN A RELATIVISTIC QUARK MODEL. Parashar, D.; Dobson, P.N., Jr., (Department of Physics and Astronomy, University of Hawaii, Honolulu, Hawaii 96822). Phys. Rev. D 9: No. 1, 185-189 (1 Jan 1974).

A version of the relativistic quark model with phenomenological form factors and prescriptions developed largely by Mitra and coworkers is here applied to the calculation of some rare meson-decay rates. First, vector-meson dominance is incorporated into the model and electromagnetic decay rates are computed for pseudoscalar and vector mesons. Then some three-body decays of the η' (958), A_1(1070), and E(1422) are considered. In general, reasonably good agreement with the available experimental evidence is obtained, without the introduction of any new parameters. It is found that the best over-all consistency is obtained if the η' (958) is assumed to be a pure SU(3) singlet, and the E(1422) is taken to be an octet state with $J^P = 1^+$. (auth)

11197 ANALYSIS OF $\bar{P}P$ ELASTIC SCATTERING USING TWO COHERENT EXPONENTIALS. Crawley, H.B.; Dean, N.W.; Hafen, E.S.; Kernan, W.J.; Ogino, F. (Ames Laboratory–USAEC and Department of Physics, Iowa State University, Ames, Iowa 50010). Phys. Rev. D 9: No. 1, 189-200 (1 Jan 1974).

Published data from many groups on $\bar{p}p$ elastic scattering at twenty-eight laboratory momenta have been analyzed with a parametrization corresponding to two coherent interfering exponentials. The data from almost all of these experiments can be adequately represented by this parametrization. In most of the experiments the data are such that the fit does not uniquely determine all five parameters with reasonable errors. In fits to at least eight experiments the parameters are well determined. Using these parameters as guides, attempts are made to reduce the total number of parameters and still fit all the data. (auth)

11198 VENEZIANO-TYPE FORMULA FOR KK- AND $K\bar{K}$-SCATTERING AMPLITUDES. Yang, S. D. (Kyoto Univ.). Mem. Fac. Sci., Kyoto Univ., Ser. Phys., Astrophys.; 34: No. 2, 139-147(Feb 1973).

The Veneziano model for KK- and $K\bar{K}$-scatterings is discussed by taking into account two Regge trajectories independently, namely ρ–f, and ϕ–f' trajectories. These Veneziano-type scattering amplitudes are available for calculating the ratio of partial decay widths and the S-wave scattering lengths. Finally these results are compared with the experimental data and those calculated by the method of current algebra. (auth)

11199 EXISTENCE OF G RESONANCE WITH ZERO ISOSPIN IN 4π SYSTEM. Dubovikov, M. S.; Matsyuk, M. A.; Nilov, A. F.; Sokolov, A. P. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 19: No. 5, 1109-1114(May 1974). (In Russian).

Arguments are presented in favor of that a resonance with zero isospin (g_0) exists in the 4π system in the mass region of the g (or ρ') meson. To get an agreement with the experimental data, available in the literature as well as newly presented, it is necessary: spin and parity of g_0 are $J^P = 3^-$ (the quantum numbers 2^+, 4^+ are also not excluded, however 3^- is preferable in view of absence of the decay $g_0 \to 2\pi^0$); for the reaction $\pi^-p \to \pi^0\Delta^{++}$ the matrix element $\rho_{33} < 0.2$ at small t. (The last is in agreement with the experimental data within the errors.) (auth)

Strong (Baryon No. = 1)

Refer also to abstracts 11400 and 11611.

11200 (IFVE-STF-72-114) AVERAGE MULTIPLICITY OF HADRONS IN THE QUARK MODEL. Anisovich, V. V.; Kobrinskii, M. N.; Likhoded, A. K.; Shekhter, V. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 9p. (In Russian). INIS.

Measurements carried out on ZhVK "Mirabel" in Serpukhov show that at the same energies the average multiplicity in meson-proton collisions is somewhat greater than the average multiplicity in proton-proton collisions. It is noted that this difference can be understood within the framework of the quark model, where the multiplicities should be equal at energies satisfying the condition $E_{nucl.} = 3/2E_{mes}$ in the laboratory system of coordinates. (SJR)

11201 (IFVE-STF-73-15) DISPERSION RATIOS AND $\pi^-p \to \pi^0n$ CHARGE-EXCHANGE REACTION AT HIGH ENERGIES. Solov'ev, L. D.; Shchelkachev, A. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 8p. (In Russian). INIS.

It is shown that Serpukhov measurements of π^+p scattering and of db^{ex}/dt at zero angle can be harmonized with dispersion relations without subtraction and with the theory of complex moments only at the expense of introducing additional free parameters, namely, it is necessary to take into account at least two (or more) polar features in the complex moment plane. It is significantly easier to obtain agreement by assuming the existence of additional radiation corrections to the π^+p scattering amplitude. It is also not excluded that the real part of the charge-transfer amplitude tends to a constant value different from zero as $E \to \infty$, and it is necessary to use dispersion relations with subtraction. (SJR)

11202 (JINR-E2-7734) ISOSPIN- AND ISOSPIN-SPIN-POLARIZATIONS OF INTERACTING HADRONS. Ion, D. B.; Mihul, A. C. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

Two new dynamical variables: the isospin-polarization and isospin-spin polarization of a hadron in the final state of a given reaction. As an application the nucleon isospin-polarization in pion-nucleon scattering is studied. The numerical results for nucleon iso-polarization, determined from π^-p-elastic and charge exchange reactions, are discussed. (auth)

11203 (JINR-E2-7890) NEW INVARIANT DESCRIPTION OF THE NUCLEON MEAN-SQUARE RADIUS. Skachkov, N. B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

It is shown that the invariant definition of the nucleon mean-square radius can be connected with the nucleon spatial distribution in an arbitrary reference frame (but not only in the Breit system) if the coordinate space is introduced with the help of expansions on the Lorentz group. (auth)

11204 (NAL-CONF-73-28-THY-EXP) IMPACT PICTURE FOR STRONG INTERACTIONS. Walker, J. K. (National Accelerator Lab., Batavia, Ill. (USA)). Apr 1973. 18p. (CONF-730334-11). Dep. NTIS $4.00.

From 8th Rencontre de Moriond conference; Meribel-les-Allues, France (4 Mar 1973).

A brief discussion of the general characteristics of the impact picture is given. This leads to a description of a phenomenological model of hadron scattering which on the one hand satisfies the impact picture at extremely high energies and on the other successfully describes the data above 20 GeV in the laboratory. In addition, many predictions on the general behavior of high energy hadron-hadron interactions are given. (auth)

11205 (UH-511-154-73) WEAK AND STRONG DECAYS OF BARYONS. Pakvasa, S. (Hawaii Univ., Honolulu (USA)). May 1973. Contract AT(04-3)-511. 5p. Dep. NTIS $4.00.

Some regularities in nonleptonic weak decays of baryons are recalled, and a similar structure for medium strong decays of baryons is suggested. (JFP)

11206 CHARGED PARTICLE MULTIPLICITY DISTRIBUTIONS IN pp, $\pi^\pm p$ AND $K^\pm p$ SCATTERING AND THE APPROXIMATELY NORMAL DISTRIBUTION. Kaiser, G. D. (Science Research Council, Daresbury, Eng.). J. Phys., B (London); 7: No. 6, 681-691(11 Apr 1974).

It is shown that the approximately normal distribution for the production of j negatively charged particles describes the charged particle multiplicity data in $\pi^\pm p$, $k^\pm p$ and pp scattering with laboratory momenta in the range 5 to 300 GeV/c. Energy dependent parametrizations of the pp and π^-p data are shown to be successful, and to become independent of the initial state as energy becomes large. It is also demonstrated that, if $Q(j) = \ln[\sigma(j)/\sigma(j-1)]$ is plotted as a function of available energy, universal curves result. These are used to predict K^-p multiplicity distributions at a laboratory momentum of 150 GeV/c. A brief discussion of the importance of diffractive scattering is included. (auth)

11207 LIFETIME OF THE PROTON AND POSSIBLE HIGHER MASS METASTABLE PARTICLES. Smith, P. F. (Rutherford Lab., Chilton, Eng.). Nuovo Cim.; 21A: No. 3, 567-582(1 Jun 1974).

The lifetime of the proton is calculated on the assumption that it is composed primarily of three heavy integrally charged parton subunits which can themselves decay into low-mass particles via weak, electromagnetic, or similar interactions. Values typically of order 10^{40} years and above are obtained for free-parton masses in the region of (10 to 100) GeV. The effect is explored of the number of particles and vertices involved in the decay and it is shown that the experimental lower limit on the proton lifetime ($\sim 10^{29}$ years) appears to rule out a simple two-body decay of the constituents. The calculations are extended to other possible parton structures and it is noted that on some decay models the diparton lifetime could be in the region $\sim 10^4$ years or more. It is also noted that particle schemes based on an extended lepton family predict the possible existence of a heavy proton of mass ~194 GeV with a stability comparable to the ordinary proton. (auth)

11208 COMMENT ON REAL PARTS OF KN AND $\bar{K}N$ ELASTIC AMPLITUDES. Phillips, R. J. N. (Rutherford Lab., Berkshire, Eng.). Nucl. Phys.; B72: No. 3, 481-486(1974).

It is observed that $K_1^0 N \to K_2^0 N$ regeneration measurements contain information about forward real parts, which has not been exploited hitherto, and which disagrees with some of the present Coulomb interference results. Charge exchange scattering also contains real part information, not measured by other means. (auth)

11209 SEARCH FOR A DOUBLE-POMERON-EXCHANGE CONTRIBUTION IN THE REACTION $K^-p \to K^-(\pi^-\pi^+)p$ AT 14.3 GeV/c. Denegri, D. (CEN, Saclay, France); Barloutaud, R.; Borg, A.; Louedec, C.; Pierre, F.; Spiro, M.; Chaurand, B. Nuovo Cim.; 21A: No. 3, 556-566(1 Jun 1974).

The $\pi^+\pi^-$ system produced in the reaction $K^-p \to K^-(\pi^+\pi^-)p$ at 14.3 GeV/c is strongly enhanced in the $\pi\pi$ near-threshold region and is consistent with having a large $\pi\pi$ S-wave component. The double-pomeron-exchange mechanism contribution to its production is found to be at most 4% for the mass region $M(\pi^+\pi^-) \leq 0.6$ GeV. The low-mass $\pi^+\pi^-$ system is consistent with being entirely produced in conjunction with the $K\pi\pi$ and $N\pi\pi$ diffraction dissociation clusters corresponding to incident K and proton fragmentations respectively. (auth)

11210 NONRELATIVISTIC πN INTERACTION. Dilitg, M. (Univ., Erlangen, Nuremberg). Lett. Nuovo Cim.; 10: No. 1, 4-8(4 May 1974).

It is suggested to construct a nonrelativistic interaction operator directly from nonrelativistically invariant quantities, such as momentum, spin, isospin, and parity. It is shown that relativistic effects will modify appreciably the nonresonant πN interaction Hamiltonian as soon as the energies of the pion become comparable with or greater than the rest mass of the π. (LBS)

11211 SYSTEMATICS OF RISING TOTAL HADRONIC CROSS SECTIONS. Chanda, R.; Hug, M. (Univ. College, Dublin). Lett. Nuovo Cim.; 10: No. 2, 59-62(11 May 1974).

A relation between the value of the plateau cross section and the value of the energy at which hadronic cross section begins to rise is pointed out. The relation is used to predict the energies at which π^+p, π^-p, and K^-p total cross sections should start rising. A possible interpretation of this relation is given. Several consequences of rising hadronic cross sections are enumerated. (LBS)

11212 RE-EXAMINATION OF THE ARGUMENTS FOR BARYON PARITY DOUBLETS. Enflo, B. O. (Univ. of Stockholm). Fortschr. Phys.; 21: No. 4, 185-204(1973).

The arguments for baryon parity doubling are re-examined by use of a spin formalism developed previously. It is shown that the transformation between good parity amplitudes and helicity flip and nonflip amplitudes in πN scattering is ambiguous. It is further shown that the unitary condition for boson-fermion scattering gives no information of the parity of intermediate states contributing to a good parity amplitude. These ambiguities follow from the fact that for boson-fermion scattering the CPT transformation of an amplitude does not commute with the projection on a definite parity. It is finally shown how a Regge pole model with linear trajectories without parity doubling can be constructed without any specific dynamical assumptions or artifices. The constraints on the residues needed in this case do not violate any general principles. (auth)

11213 A_2 PRODUCTION IN π-p COLLISIONS AND POMERON EXCHANGE. Conforto, Gianni. (Instituto Nazionale di Fisica Nucleare, Rome). pp 401-409 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The density matrix elements obtained in experiments studying the A_2 production from pions via the decays $A_2 \rightarrow \eta\pi$ or $A_2 \rightarrow K\bar{K}$ show that the energy dependence of the natural parity exchange component of the total cross section is consistent with the 1/P (inc) law and does not support the conclusion reached from the $A_2 \rightarrow \rho\pi$ data that some Pomeron exchange must be present in the production process. (auth)

11214 EXCHANGE MECHANISMS FOR $\pi^-p \rightarrow \rho^0 n$ AND $\rho-\omega$ INTERFERENCE. Estabrooks, P.; Martin, A. D.; Michael, C. (CERN, Geneva). Nucl. Phys.; B72: No. 3, 454-460(1974).

The 17-GeV/c $\pi^-p \rightarrow \rho^0 n$ production amplitudes are decomposed into π, A_2, and nonevasive exchange contributions. Independent support for this description comes from the observed $\rho-\omega$ interference effects and from the energy dependence of ρ^0 production data. (auth)

11215 SOME PROPERTIES OF ABSORPTIVE CORRECTIONS. Martin, A. D.; Estabrooks, P. (CERN, Geneva). pp 451-462 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

Absorptive corrections to Regge pole exchange are isolated in a nonflip $\pi^-p \rightarrow \pi^-\pi^+n$ reaction amplitude. The strength of absorption is found to decrease rapidly as the mass of the produced $\pi^-\pi^+$ system increases. In particular, the Williams model, which has been found to give a good fit of the small t data in the ρ region, is no longer satisfactory in the f region. (auth)

11216 πN SCATTERING AMPLITUDES AT INTERMEDIATE AND HIGH ENERGIES. Hoehler, G. (Univ., Karlsruhe, Ger.). pp 21-42 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

The lectures on π + N scattering amplitudes at intermediate energies cover small momentum transfer, impact parameter representation, eikonals, optical potentials, and isospin bounds. (JFP)

11217 ELASTIC-SCATTERING AMPLITUDES AT t = 0. Dronkers, J. (CEN de Saclay, Gif-sur-Yvette, France). Nuovo Cim.; 21A: No. 4, 707-722(21 Jun 1974).

A study is made of the KN and πN elastic-scattering amplitudes in the forward direction and a comparison is made with the ISR pp total cross section data. For the high energy part of the amplitudes a very simple phenomenological description is given, based on duality and SU_3 symmetry. Good agreement with dispersion relations is obtained when the pomeron contribution at low energy is taken from experimental data. The pomeron contributions to the πN, KN and pp total cross sections are shown to be equal up to a normalization constant when the energy is properly scaled for each contribution. The difference between the energy scale factors in baryon-baryon scattering and meson-baryon scattering is larger than may be expected from an additive quark model. It is predicted that the proportional increase of σ_{K^+p} will be the same as for σ_{pp} at energies which are 6 to 10 times smaller. (auth)

11218 USE OF THE APPROXIMATELY NORMAL DISTRIBUTION TO DESCRIBE THE PRODUCTION OF NEUTRAL PARTICLES. Kaiser, G. D. (Science Research Council, Daresbury, Eng.). J. Phys., B (London); 7: No. 6, 692-704(11 Apr 1974).

The normal distribution in two variables is used in an approximate form to describe the data on the reactions pp, π^-p or $\pi^-n \rightarrow$ (j negatively charged particles) + (neutral pions). It is shown that the model predicts a linear relation between j and the mean number of neutrals. Modifications of the model are proposed in order to incorporate specific isospin conserving mechanisms. Comparisons are made with the work of other authors. Neutral strange particle production is discussed. (auth)

11219 CALCULATION OF THE CONTRIBUTION OF THE SIGMA-COMMUTATOR TO THE πN SCATTERING AMPLITUDE. Radatskii, G. M. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 6, 128-130(1973). (In Russian).

The results of the calculation of the σ contribution using the expressions for the πN scattering amplitude obtained by Radutsky and and Tabachenko in a current-algebra model with hard pions were reported and compared with the values obtained by other methods. (JSR)

11220 PHENOMENOLOGICAL DISPERSION THEORY OF KN SCATTERING. Queen, N. M. (Univ. of Birmingham, Eng.); Restignoli, M.; Violini, G. Fortschr. Phys.; 21: No. 11, 569-607(1973).

A survey is given of the present state of experimental and theoretical knowledge of the kaon-nucleon interaction, with special attention to recent applications of phenomenological dispersion theory in elucidating this interaction. Various alternative methods of analyzing the data are compared and contrasted. The topics covered include the low energy parameters, dispersion relation calculations of the real parts of the forward scattering amplitudes and the KNY coupling constants, analyses of the data by recently developed analytic continuation techniques, and high energy phenomenology. (auth)

11221 CROSS SECTION OF ηN INTERACTION IN THE REGION OF S_{11} N* (1535) RESONANCE. Dudkin, G. N.; Eponeshnikov, V. N.; Krechetov, Yu. F.; Tryasuchev, V. A. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 119-122(1973). (In Russian).

The integral cross sections of the $\eta N \rightarrow \eta N$ and $\eta N \rightarrow \pi N$ processes were calculated with consideration of the one-particle intermediate state, the $S_{11}N^*$ (1535) resonance. Cross sections were reported for the kinetic energy of the η meson from 0 to 200 MeV for different values of the width Γ of this resonance. The calculated cross sections agree with experiments at $\Gamma \approx 160$ MeV. (tr-auth)

11222 MULTIPLE SCATTERING EFFECTS ON THE COMPOSITE MODEL FOR KN AND $\bar{K}$N ELASTIC AND CHARGE-EXCHANGE PROCESSES. Tanimoto, M. (Hiroshima Univ.). Progr. Theor. Phys. (Kyoto); 50: No. 6, 1945-1957(Dec 1973).

The $K^\pm N$ elastic and charge-exchange scattering up to several GeV/c is investigated by using the multiple scattering theory. In the present treatment it is assumed that hadrons are composed of quarks and when a hadron collides with another hadron the conventional Regge poles are exchanged between constituent quarks of each hadron. The hadron-hadron scattering amplitudes are then written in terms of the Regge amplitudes. The multiple scattering effect is calculated to second order. The dip-bump and break observed in differential cross sections are explained by the interference between the single and the double scattering terms. However the multiple scattering effect for spin-flip amplitude is neglected to fit the cross sections of K^-p charge exchange process. The polarization and spin rotation parameters are also calculated. (auth)

11223 HIGH ENERGY COLLISIONS AND COMPOSITE MODEL. Kuroda, M.; Miyazawa, H. (Tokyo Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 1, 205-211(Jan 1974).

Under the assumption that the constituents of hadrons (quarks) have a simple isotropic scattering amplitude, hadron-hadron scattering at high energy is calculated. Proton-proton differential cross section is nicely reproduced. The slope of pion-proton differential cross section can be fitted if the root mean square radius of the pion is $\simeq$0.5fm. (auth)

Strong (Baryon No. $\geq$ 2)

Refer also to abstracts 11364-11368.

11224 (IFA-HE-84-1974) INTERPRETATION OF RECENT DATA ON PROTON-NUCLEUS COLLISION AT VERY HIGH ENERGIES. Friedlaender, E. M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

An intuitive model of nuclear meson production is formulated which reproduces all the experimental facts. It includes the model of the energy flux cascade. (JFP)

11225 (MATSCIENCE-78, pp 129-131) DEUTERON FORM FACTORS WITH SOFT-CORE POTENTIALS. Srinivasa Raghavan, S. (Coll. of Engineering, Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The deuteron form factors were evaluated with two different soft-core potentials in order to see whether both the potentials give identical results in the form factor calculations. The Reid and the velocity-dependent soft-core potentials are used. The ground-state deuteron wave functions are obtained by direct numerical integration of the Rarita-Schwinger equation. (JFP)

11226 ENERGY DEPENDENCE OF THE CHOU-YANG MODEL. Carreras, B.; Mallado, I. (Junta de Energia Nuclear, Madrid). Lett. Nuovo Cim.; 10: No. 5, 194-196(1 Jun 1974).

An analysis was made of experimental data on pp interactions at ISR energies in order to see if energy dependence can be incorporated in the Chou-Yang model. (LBS)

11227 HELICITY STRUCTURE OF THE SCALARLIKE EXCHANGE EFFECT IN NUCLEON–NUCLEON SCATTERING. Suemitsu, H.; Susuki, Y. (Hiroshima Univ.). Lett. Nuovo Cim.; 10: No. 5, 179-181(1 Jun 1974).

The experimental nucleon–nucleon partial-wave amplitudes were analyzed by the K-matrix method and the partial-wave dispersion relation. The data were fitted by the one-boson exchange model taking four mesons: $I^G = O^+$, $J^+ = O^+$ meson S(410) MeV, π, ρ, and ω meson. It is concluded that the scalarlike exchange effect has the helicity structure of the conventional scalar-meson exchange in the elastic region. (LBS)

11228 MINIMAL RULE OF HADRON SCATTERINGS. Shui-Yin, L. (Univ., Melbourne). Lett. Nuovo Cim.; 10: No. 2, 41-46 (11 May 1974).

A minimal rule for hadron scatterings at high energy was proposed, which states that for processes $a + b \rightarrow a^+ + b^+$, the longitudinal momentum transfer Δp_L between a and a^+ approaches zero as energy increases. The relevance of the minimal rule for inclusive spectra of $pp \rightarrow y +$ anything at ISR energy is demonstrated. (LBS)

11229 CONCLUSIONS FOR THE EIGHTH MORIOND ON THE POMERON. Leith, D. W. G. S. (Stanford Linear Accelerator Center, CA). pp 607-617 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The Pomeron properties were discussed at the VIIIe Moriond, through diffractive processes at ISR energies. Diffraction was studied in the following reactions: elastic scattering, inelastic scattering-diffraction dissociation and inelastic scattering-single particle inclusive. Two methods used for obtaining total cross sections were discussed. Another area of considerable interest was the question of shrinkage in p–p scattering. (auth)

11230 HIGH ENERGY THEOREMS FOR PARTICLE–PARTICLE AND PARTICLE–ANTIPARTICLE SCATTERING AND ISR DATA. Martin, A. (CERN, Geneva). pp 91-102 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The asymptotic theorems which constrain the elastic scattering amplitude from first principles: positivity, analyticity and unitarity are reviewed. This is done in the light of the recent ISR data on total cross sections for pp scattering which show a rise with energy, possibly like $\log^2 s$. Results for the differential cross sections (zeros in the forward region, width of the diffraction peak, behavior of sigma(el) and for the ratio Re F/Im F are given. (auth)

11231 HADRONIC SCATTERING AT SMALL AND LARGE MOMENTUM TRANSFERS. Fried, H. M. (Brown Univ., Providence). pp 281-288 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The nature of possible corrections to the Cheng-Wu forward-direction amplitude is examined on the basis of a complete eikonal formulation, which suggests strong cancellations away from the Froissard bound. Two models of wide-angle scattering, the interchange model and the hadronic bremsstrahlung model, are briefly discussed and compared. (auth)

11232 THEORY OF NUCLEON–NUCLEON SCATTERING. Barut, A. O. (International Centre for Theoretical Physics, Trieste, Italy); Baran, S. A.; Uenal; B. C. Fortschr. Phys.; 21: No. 11, 609-651(1973).

A new study of kinematical problems of relativistic nucleon–nucleon interactions, more complete than the previous studies. Two-component spinor formalism is used throughout. Several choices of spinor bases, their relations, crossing relations in all channels, helicity amplitudes, partial-wave amplitudes, the absence of kinematical singularities, and unitarity are discussed. The contributions of arbitrary intermediate states J in the unitarity are summed and the Regge forms for all five scalar amplitudes are obtained. (auth)

11233 MODEL-INDEPENDENT DETERMINATION OF LOW-ENERGY PARAMETERS FOR THE PP SCATTERING AMPLITUDE. Hashimoto, N.; Kanazawa, A. (Department of Physics, Hokkaido University, Sapporo, Japan). Phys. Rev. D 9: No. 1, 317-319 (1 Jan 1974).

The low-energy parameters, a_{pp} and r_{pp}, of the $^1S_0$ pp scattering amplitude are estimated nearly model-independently by using as input the results of phase-shift analyses and the proper cut structure via Ciulli, Cutkosky, and Deo. a_{pp} and r_{pp} referred to are those assuming the Coulomb interaction to be zero. The calculations are carried out, assuming that the phase-shift data obtained by MacGregor and others have no Coulomb interference effects above a certain energy, called the cutoff energy in this paper. It has been found that $a_{pp}r_{pp}$ take nearly the same values for various cutoff energies chosen in the range 8 to 20 MeV, though their errors vary considerably. When the cutoff energy is 16 MeV, we have $a_{pp} = -10.5^{+2}_{-6}$ fm and $r_{pp} = 2.57^{-0.3}_{+0.3}$ fm, which are consistent with those obtained for potential models within our large uncertainties. (auth)

11234 DESCRIPTION OF THE TRIPLE-REGGE REGION WITH A VERY LARGE TRIPLE-POMERON COUPLING AND A BARE POMERON. Dash, J.W. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. D 9: No. 1, 200-207 (1 Jan 1974).

A description of data in the triple-Regge region up to CERN ISR energies is proposed. The description utilizes a very large PPP (triple-Pomeron) coupling g_P and assumes that the "bare" or "unrenormalized" Pomeron controls the region near $x=1$. The "bare" Pomeron intercept is $\tilde{\alpha}_0 = 0.85$. One secondary term is employed to extend the description to $x=0.7$. This term is chosen to be of the form $\pi\pi P$. We use a modified ABFST (Amati-Bertocchi-Fubini-Stanghellini-Tonin) model to roughly constrain g_P and $\tilde{\alpha}_0$. The number of unconstrained parameters otherwise is one. Other phenomenological applications utilizing the bare Pomeron as the definition of diffraction at intermediate energies are discussed, and the total cross section with and without diffraction is discussed in the context of the ABFST model. (auth)

11235 RIGHT–LEFT MULTIPLICITIES AND THE POMERANCHUK SINGULARITY. Sivers, D.; Thomas, G.H. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. D 9: No. 1, 319-322 (1 Jan 1974).

The left–right multiplicity cross sections for producing n_L particles in the left c.m. hemisphere and n_R particles in the right c.m. hemisphere are discussed. It is found that these distributions provide a set of quantitative tests for the existence of a nonfactorizable part of the Pomeranchuk singularity. It is also found that the multiplicity distribution in a single hemisphere is a more sensitive test of the Wilson two-component idea than is the total multiplicity distribution. New NAL data show evidence for such a two-component structure. (auth)

11236 RELATIONSHIP BETWEEN THE TRIPLE-POMERANCHUKON COUPLING AND THE POMERANCHUKON SLOPE AT MINIMUM MOMENTUM TRANSFER. Buchl, R.A.; Nigam, B.P. (Department of Physics, Arizona State University, Tempe, Arizona 85281). Phys. Rev. D 9: No. 1, 325-327 (1 Jan 1974).

A relationship is given that shows the proportionality of an integral involving the triple-Pomeranchukon coupling $g_P(t)$, where t is the momentum transfer, to the Pomeranchukon slope α'_P. This relation involves the measurable total pp cross section and also a quantity determined from the elastic pp cross section. It is found that $g_P(t_0)$ may vanish, where t_0 is the minimum momentum transfer.

11237 NUCLEON SPECTRA IN pp COLLISIONS AND THE REGGEIZED π-MESON EXCHANGE MODEL. Boreskov, K. G.; Kaidalov, A. B.; Ponomarev, L. A. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 19: No. 5, 1103-1108(May 1974). (In Russian).

The reggeized π-exchange model is used to describe the nucleon spectra in the pp collisions. It is shown that the model describes quantitatively the neutron and proton spectra and gives an appropriate energy behavior of inclusive cross sections. The parameters of the model are consistent with the inclusive data. (auth)

11238 MODEL OF THE MULTIPLICITY DISTRIBUTION IN pp COLLISIONS FROM 5 TO 300 GeV/c. Chaudhary, B. S.; Gupta, V.; Narayan, D. S. (Tata Inst. of Fundamental Research, Bombay). Pramana; 2: No. 2, 73-79(Feb 1974).

The multiplicity distribution of charged particles in pp-collisions in the range 5 to 300 GeV/c is explained on the basis of a dynamical model which leads to a specific mixture of Poisson distributions. (auth)

11239 RESOLUTION OF THE RAPID ENERGY DEPENDENCE OF pp-POLARIZATION. Biyajima, M. (Osaka Univ.). Progr. Theor. Phys. (Kyoto); 50: No. 6, 1908-1915(Dec 1973).

From SU(3) symmetry of Regge residues and s-channel helicity conservation, a polarization relation $P(pp) = P(K^+p)/4$ is derived. $\Delta P \equiv P(pp) - P(K^+p)/4$, the violation of the above relation, vanishes rapidly as P_L increases ($O(P_L^{-2})$, $6 \leq P_L \leq 14$ GeV and $0.12 \leq |t| \leq 0.27$ GeV^2). Using this fact and Finkelstein's double Reggeon exchange (DRE) selection rule, it is concluded that the rapid energy dependence of P(pp) is attributed to the interference

between DRE in nonflip amplitude and the universal ρ and A_2 contributions to single-flip amplitude. (auth)

Particle Invariance Principles and Symmetries

Refer also to abstract 11760.

General

11240 (FAI-19) SOME REPRESENTATIONS OF INHOMOGENEOUS GROUPS. Loide, R. K. (AN Ehstonskoj SSR, Tartu. Inst. Fiziki i Astronomii). 1972. 15p. INIS.

A number of studies on invariant equations use operators which are related to invariant inhomogeneous groups (Poincare group and inhomogeneous group of deSitter). It turns out that not in all cases is it possible to use these operators in their original sense. This study considers the case, when the moment operators have the form M = L + S, where the L-operators of the orbital moment and the S-generators of a certain finite space moment are representations of a homogeneous group. It is shown that for $p^2 = 0$ the displacement operators of a small group do not have their original value. These operators do not have eigenvalues different from zero. The requirement that displacement eigenvalues of a small group should equal zero denotes in this case an additional condition which isolates certain points of the weighting diagram. (SJR)

11241 (IFVE-STF-73-24) MATRIX ELEMENT ASYMPTOTICS FOR IRREDUCIBLE REPRESENTATIONS ON THE $(n + 1) \times (n + 1)$ PSEUDOUNITARY MATRICES OF U(n,1) GROUP. Leznov, A. N.; Savel'ev, M. V.; Khrushchev, V. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 20p. (In Russian). INIS.

A value is obtained for the coefficient on the main member of an asymptotic decomposition of the matrix element of irreducible representations of a group of pseudounitary matrices of (n + 1) order U(n,1), while the noncompact parameter tends to infinity. It is shown that this coefficient coincides (with an accuracy of that of the numerical multiplier and of Weyl's representation) with the kernel of the invariant hermitian form, so that it is possible to carry out a complete separation of invariant spaces and to construct all the completely irreducible representations (including also the unitary) of the group at an integral point. (SJR)

11242 INDUCTION IN PHYSICS. Toraldo di Francia, G. (Univ., Florence). Riv. Nuovo Cim.; 4: No. 1, 144-165(1974).

It is described how the procedure of scientific inference appears to be applied by modern physicists. It is shown that the only rule of induction which is applied with some confidence in modern physics is derived from the postulate of space–time invariance. All other types of inference may be applied on psychological or heuristic levels but are well known to be unreliable or even to be definitely wrong. (JFP)

11243 ASYMPTOTIC PROPERTIES OF A QUANTUM NUMBER Ω IN A SYSTEM WITH SU(3) SYMMETRY. Asherova, R. M.; Smirnov, Yu. F. (Moscow State Univ.). Rep. Math. Phys.; 4: No. 2, 83-95(Apr 1973).

The asymptotic properties of the basic vectors for the $(\lambda\mu)$ irreducible representations of the SU(3)-group in the SU(3) $\supset$ SO(3) reduction (Elliott's basis) are investigated for large values of λ or μ. The matrix of the Bargmann–Moshinsky operator Ω in Elliott's basis is analyzed for the same limiting case. Approximate expressions for the eigenvalues and eigenvectors of the operator Ω are found. They demonstrate the asymptotic properties of the operator Ω to be very close to those of the rigid quantum top. (auth)

11244 ANOMALOUS DIMENSIONS AND THE RENORMALIZATION GROUP EQUATIONS. Shizuya, K. (Tokyo Univ.). Nucl. Phys.; B73: No. 2, 339-350(1974).

An interpretation is given of scale and anomalous dimensions in the framework of the renormalization group, and the renormalization group equations are derived which are regarded to represent the conservation of these scale dimensions. By the use of continuous dimensional regularization all coefficient functions appearing in these equations and in the Callan–Symanzik equations are explicitly expressed in terms of the residues of the single poles at n = 4 as well as the finite part of renormalization counter-terms. (auth)

11245 GROUP-THEORETIC STRUCTURE OF CHIRAL-REPRESENTATION MIXING. Ebrahim, A. (Middle East Technical Univ., Ankara). Lett. Nuovo Cim.; 10: No. 1, 16-18(4 May 1974).

The group-theoretic structure of the operators that generate the chiral group of current algebra and those that have measurable matrix elements between physical single-particle hadronic states is considered for the case of SU(3) × SU(3) symmetry. (LBS)

11246 DE SITTER SPECTRA. Aguirre, E.; Esteve, A. (CSIC, Madrid). Nuovo Cim.; 21A: No. 4, 743-759(21 Jun 1974).

The principal series of the unitary irreducible representations of the noncompact symplectic group $Sp_{1,1}$ are constructed using a generalization to the quaternionic field of Graev's paper on $U_{p,q}$. The spectra of these representations are explicitly calculated. Since $Sp_{1,1}$ is the covering of the de Sitter group $O_{1,1}$, its invariants are related by contraction to those of the Poincaré group. (auth)

11247 DIMENSIONS OF THE CHIRAL AND DILATATION SYMMETRY BREAKING HAMILTONIAN DENSITIES. Cornwell, D. T.; Genz, H. (Univ., Karlsruhe, Ger.). Fortschr. Phys.; 21: No. 10, 559-568(1973).

Denoting by l_u and l_δ the dimensions (if any) of the chiral and dilation symmetry breaking Hamiltonian densities u(x) and $\delta(x)$, respectively, the property $(4 - l_u)(l_u - l_\delta) > 0$ (which is already known in special cases) is derived for a much larger class of models. Furthermore a simple and general explicit expression is obtained for u(x) in terms of the current divergences, and the physical applications of this (or an analogous, almost obvious) expression are reviewed. (auth)

11248 INFINITE-DIMENSIONAL REPRESENTATIONS OF THE LORENTZ GROUP. The Complete Series. Carmeli, M.; Malin, S. (Univ. of the Negev, Beersheba, Israel). Int. J. Theor. Phys.; 9: No. 3, 145-156(Mar 1974).

The method used by Carmeli (J. Math. Phys.; 11: 1917 (1970)) to obtain a new form for the principal series of representations of the group SL(2, C) is further generalized to all completely irreducible (finite and infinite-dimensional) representations of that group. This is done, following Naimark (Doklady Akademii nauk SSR; 97: 969 (1954)), by extending the meaning of one of the parameters appearing in the formula for the operators of the principal series of representations. As a result a new form for the complete series of representations of the group SL(2, C) is obtained which describes the transformation law of an infinite set of quantities under the group translation in a way which is very similar, but as a generalization, to the way spinors appear in the finite-dimensional case. The finite-dimensional representation is then discussed in detail, and the relation between the new set of quantities (which becomes finite in this case) and 2-component spinors is found explicitly. (auth)

11249 STRONG COUPLING METHOD IN THE SCALAR SU(3)-SYMMETRIC THEORY. Tolstenkov, A. N.; Tyurin, N. E.; Shurgaya, A. V. (Inst. of High Energy Physics, Serphukhov, USSR). Teor. Mat. Fiz.; 19: No. 2, 208-216(May 1974). (In Russian).

On the basis of the N. N. Bogoliubov method in the strong coupling limit the SU(3)-symmetric scalar static theory is investigated. The perturbation theory series in the inverse powers of the coupling constant g is constructed, which takes rigorously into account the laws of the isotopic spin and the hypercharge conservation. Levels of the excited states of the system are calculated. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstract 11142.

11250 TESTING THEORIES OF CHIRAL SYMMETRY. Ng, W. C. (State Univ. of New York, Stony Brook). Fortschr. Phys.; 21: No. 12, 667-701(1973).

Various physical consequences of theories of chiral symmetry are investigated. Predictions of the symmetry are given for the meson electroproduction process at an on-shell kinematical point where unknown contributions are minimized. Sum rules are derived for the corrections. Then a sum rule is presented for the Σ term in meson-baryon scattering from the assumptions of Bjorken limit, precocious asymptopia, and finite-mass dispersion relations. The commutation relations of the gluon model are used as input for a numerical evaluation. Next the explicit canonical structure of the light-cone restriction of the commutator of the weak current with its divergence is considered in the interacting quark-gluon model quantized in the infinite–momentum frame. The implications on neutrino scattering are analyzed. W_4 and W_5 are predicted to scale nontrivially as $\nu^{-2}F_4(\omega)$ and $\nu^{-2}F_5(\omega)$, which provides a simple test of light-cone current algebra feasible in the near future. The Σ term for weak currents is deduced from a causal representation near the light-cone, and a correction is also made in the W_5-sum rule obtained by naive infinite momentum techniques. As a by-

product improved derivations of the Adler neutrino sum rules are obtained. (auth)

11251 COMMENT ON EXPERIMENTAL TESTS OF CPT INVARIANCE. Hsu, J.P. (Department of Physics, Rutgers–The State University, New Brunswick, New Jersey 08903). Phys. Rev. D 9: No. 1, 304-306 (1 Jan 1974).

We discuss some general implications and further consequences of a weak-interaction model. They are related to a new test of CPT invariance, high-energy neutrino experiments, and so on. The model suggests that the violation of CPT invariance can only be effectively detected at high energies. (auth)

Applications (Strong)

Refer also to abstract 11357.

11252 (FAI-20) ONE MORE MODEL OF CP NONCONSERVATION WITH WEAKLY COUPLED NEUTRAL HADRONIC CURRENTS. Palgi, L. (AN Ehstonskoj SSR, Tartu. Inst. Fiziki i Astronomii). 1972. 12p. INIS.

A look is taken at the current-current model in the violation of CP-invariance with the addition of neutral hadron fluxes. The hadron flux is obtained by a U-spin reversal from $\Delta S = 0$ component of a U-spin triplet. The model is adjusted to the experimental data of K-meson decays, and in the CP invariant limit the selection rule $(\Delta\vec{D} = 1/2$ is fulfilled for $\Delta S = 1$ nonleptonic transitions. (SJR)

Scattering Theory

Refer also to abstracts 11160, 11610, 11735, and 11762.

11253 (IFVE-STF-73-34) RELATIVISTIC THREE-PARTICLE EQUATIONS. Sokolov, S. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 10p. (In Russian). INIS.

From the point of view of general conditions of invariance and separability placed on wave operators and the scattering matrix, two schemes of including the potential interaction into relativistic, three-particle equations are considered. (SJR)

11254 (JINR–P4-7815) INVERSE PROBLEM IN R-MATRIX SCATTERING THEORY. Zhigunov, V. P.; Zakhar'ev, B. N.; Niyazgulov, S. A.; Suz'ko, A. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Method for reconstruction of short-range forces using a discrete set of parameters of R-matrix theory (resonance positions and their reduced widths) is suggested. (auth)

11255 THE UNITARITY EQUATION FOR SCATTERING IN THE ABSENCE OF SPHERICAL SYMMETRY. Tortorella, M. (Department of Mathematics, University of Wisconsin–Milwaukee, Milwaukee, Wisconsin 53211). J. Math. Phys. (N.Y.) 15: No. 6, 745-747 (June 1974).

We consider the problem of determining the scattering amplitude from the differential cross section at a fixed energy by using the unitarity equation when the scattering potential does not have spherical symmetry. We indicate some of the problems peculiar to this case. We prove two existence and uniqueness theorems. We give an example of nonuniqueness. (auth)

11256 ADEQUACY OF THE UNITARY POLE EXPANSION. van Haeringen, H. (Vrije Univ., Amsterdam); Kok, L. P. pp 351-352 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

Separability of model nuclear interactions simplifies the three-body problem greatly. Therefore separable approximations of local potentials, like the unitary pole expansion (UPE, its first term is UPA) were used frequently. In order to judge the quality of such approximations one usually compares the full T-matrices for the original potential and its approximation. Instead, the original potential V(r) and the potential V'(r) which generates the same on-shell T-matrix and bound state energy as V are compared. To this aim the corresponding inverse scattering problem is solved to find the local potential V'(r), which is unique. If V and V' considered as a function of r are very similar one can expect the separable approximation to work well. The comparison between V and V' is easy because of their dependence on just one variable, whereas the corresponding T-matrices depend on three variables. In addition, one works in the familiar configuration space. (auth)

11257 COMMENTS ON THE UNITARY POLE EXPANSION FOR THE MALFLIET–TJON I AND III POTENTIALS. Bakker, B. L. G.; Ruig, P. (Vrije Univ., Amsterdam). pp 357-360 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

The unitary pole expansion (UPE) was constructed for the potentials I and III of Malfliet and Tjon (1969). To obtain the solutions of the homogeneous Lippman-Schwinger equation for these potentials $G_0(-B)\ V\ |\psi_n> = n_n\ |\psi_n>$ where B is the two-body binding energy if the two-body system possesses a bound state and zero when it possesses an antibound state near zero energy but no bound state, they are expanded in terms of the solutions of the homogeneous L.-S. equation for the Hulthén potential which are known in closed form. The eigenvalues η_n obtained with this method using a set of 15 Hulthén basis functions are shown. The values of the binding energies, the scattering lengths, the effective ranges and the phase shifts for the local potential are compared to those obtained with the UPE. (auth)

11258 NUMERICAL COMPARISON OF FADDEEV AND RESONATING GROUP METHOD. Sohre, P.; Schmid, E. W. (Univ., Tuebingen, Ger.). pp 396-398 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

A comparison between an exact Faddeev result and the result of a resonating group calculation is made for a system of three identical bosons which interact by a separable Yamaguchi potential. A reliable Faddeev solution was established by two independent calculations with different integration methods. Although the comparison is made only for L = 0 elastic scattering, Faddeev results were calculated for elastic and inelastic scattering from L = 0 to 4. Results from the two calculations agree within 0.1% below the inelastic threshold and within 1 to 2% above. This accuracy was also confirmed by two- and three-particle unitarity. (auth)

11259 APPROXIMATE DYNAMICAL RELATION BETWEEN ELASTIC AND INELASTIC EIKONAL CROSS SECTIONS. Fried, H. M. (Brown Univ., Providence). Nucl. Phys.; B73: No. 1, 93-108(1974).

Heuristic derivations are given for a relation linking elastic and inelastic cross sections, satisfied in the simplest cases by the sets of field-theoretic tower graphs. (auth)

11260 SCATTERING AMPLITUDES AT HIGH ENERGIES. III. An Approach with Green's Functions. Hahn, Y. (Univ. of Connecticut, Storrs). Phys. Rev., C; 8: No. 5, 1672-1681(Nov 1973).

The scattering amplitude at high energy is calculated in various approximations, both single and double hard collisions are explicitly incorporated. For the purpose of improving the large angle behavior of the amplitude, approximations are introduced directly to the full Green's function rather than to the scattering function; this procedure avoids the usual assumption of a straight-line trajectory. The previous study using the semiclassical Green's function gave a very accurate amplitude up to a moderately large angle; its applicability to more general forms of potentials is further examined. Some of the practical difficulties in carrying out the amplitude integrals are pointed out, and the problem is simplified by introducing an angle-averaging procedure and also by an eikonal approximation to the semiclassical Green's function. These procedures are then tested by using Gaussian and Yukawa forms of the potential; they are relatively simple to apply, and the over-all accuracy is improved. (1 figure, 5 tables) (auth)

11261 SOME PROPERTIES OF THE S-MATRIX IN A MODEL COUPLED-CHANNEL CALCULATION. Quintanilla, J. (Institute Nacionale de Energia Nuclear, Mexico City); Mello, P. A. Ann. Phys. (N. Y.); 75: No. 2, 332-347(Feb 1973).

The explicit solution is given to a coupled-channel problem consisting of two open channels coupled by a separable interaction. It is shown that the cross sections exhibit one rather narrow anomaly which displaces to higher energies as the coupling is increased and at the same time its width decreases and increases alternatively. This behavior is analyzed in terms of the eigenphase-shifts and also in terms of the motion of the poles of the S-matrix as a function of the coupling strength. (auth)

11262 REGGEON THEORY OF DIFFRACTION SCATTERING. Baker, M. (Univ. of Washington, Seattle). pp 125-156 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1974).

Gribov's theory of the Pomeron is reviewed and compared to the recent ISR proton–proton elastic scattering data. (auth)

11263 DIFFRACTION PHENOMENA: REVIEW OF THE EXPERIMENTAL SITUATION. Leith, D. W. G. S. (Stanford Linear Accelerator Center, CA). pp 319-382 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The data on diffraction reactions, and by inference, on the Pomeron are reviewed and compared to the set of phenomenological rules developed to describe the processes. In the main, the data agrees with the rules, both for inelastic and elastic reactions. There are, however, some puzzling questions. (auth)

11264 SHADOW APPROACH TO DIFFRACTION SCATTERING. de Groot, E. H. (Oxford Univ.); Miettinen, H. I. pp 193-234 of Proceedings of the Eighth Rencontre de Moriond. Vol. 2. Tran Thanh Van, J. (Ed.). Orsay, France; Univ. Paris (1973).

From 8th Rencontre de Moriond; Meribel-les-Allues, France (4 Mar 1973).

The use of s-channel unitarity calculations high energy elastic scattering from multiparticle production amplitudes is discussed. The important role played by the phases of the production amplitudes for this problem is emphasized. As an illustration of the s-channel techniques, a simplified analysis of high energy elastic proton–proton scattering is performed. (auth)

11265 INVARIANT SPINORS AND THEIR USE FOR EXPANSIONS OF SCATTERING AMPLITUDES. Enflo, B. O.; Laurent, B. E. (Univ. of Stockholm). Fortscher. Phys.; 21: No. 4, 155-183(1973).

A general covariant scheme is proposed for the kinematical analysis of arbitrary reactions. By this scheme the problem of finding invariant amplitudes and corresponding kinematical covariants can be solved systematically. The amplitudes are labelled by two invariant indices for each particle related to spin and parity. The method provides a tool for exploiting the symmetries of the M-function, including crossing symmetry and the Pauli principle. Amplitudes free from kinematical singularities can easily be constructed. (auth)

11266 THEORETICAL INVESTIGATION OF PHASE-SHIFT ANALYSIS. Atkinson, D. (Inst. for Theoretical Physics, Groningen, Netherlands). pp 61-69 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

Some results obtained previously are described. Then the extension of this analysis to energies above the inelastic threshold are discussed. It is found that a continuum ambiguity is expected. The possibility of a numerical investigation of the ambiguities is briefly considered in actual cases of experimental interest. Spin and isospin complications are indicated. (JFP)

11267 EIKONAL APPROXIMATION TECHNIQUES IN ELASTIC SCATTERING AND PRODUCTION PROCESSES. Abarbanel, H. D. I. (National Accelerator Lab., Batavia, IL). pp 146-173 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

Lectures are given on a scheme having reduction from three- to one-dimensional motion for the eikonal approximation in elastic scattering and production processes. The eikonal technique in potential scattering, the eikonal approximation in quantum field theory for elastic scattering, and inelastic processes and particle production in an eikonal framework are covered. (JFP)

11268 LECTURE NOTES ON DUAL AMPLITUDES. Drummond, I. T. pp 219-244 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

The discussion of dual amplitudes covers the N-point function, Kolba-Nielson variables, factorization, gauge conditions and physical states, the Neveu–Schwarz model, and off-shell amplitudes. (JFP)

11269 STUDY OF THE SASAKAWA APPROACH TO TWO-PARTICLE SCATTERING. Blasczak, D.; Fuda, M. G. (State Univ. of New York, Buffalo). Phys. Rev., C; 8: No. 5, 1665-1671(Nov 1973).

It is shown that the Kowalski formulation of the Sasakawa approach to potential scattering can be used as the basis for a momentum-space formulation of the theory of the Jost function. Two examples are presented for which the Kowalski equations can be solved in closed form. One example is a separable potential, and the other is the exponential potential. The separable potential illustrates the fact that the series obtained by iterating Kowalski's equations does not always converge. The exponential potential provides a verification of Coester's proof that the iteration series does converge for a certain class of local potentials of arbitrary strength. The practicality of Kowalski's equations is demonstrated by using them to calculate the phase shifts and half-off-shell T matrix that are produced by the Reid potential in some of the uncoupled states of the two-nucleon system. (auth)

11270 APPLICABILITY OF DWBA METHOD TO ELASTIC SCATTERING. Garistov, V. P.; Petkov, I. Z. (Inst. of Nuclear Research and Nuclear Energy, Sofia). Compt. Rend. Acad. Bulg. Sci.; 27: No. 2, 185-186(1974).

Some reasons are given for the applicability of the DWBA amplitude to elastic scattering without an auxiliary potential. The consideration is based on a simple identity for the scattering amplitude and usage of high energy approximated trial wave functions. (JFP)

11271 NEW APPROXIMATE PROPAGATOR IN MULTIPLE SCATTERING AT MEDIUM ENERGY. Bleszynski, M.; Jaroszewicz, T. (Instytut Fizyki Jadrowej, Krakow). Lett. Nuovo Cim.; 10: No. 1, 19-24(4 May 1974).

Another very simple approximation to the multiple scattering propagator which includes in addition the off-shell effects coming from the small distances between the scattering centers (the region where the individual scatterer potentials overlap) is proposed. (JFP)

11272 BILATERAL EVALUATION OF SCATTERING AMPLITUDES OF PARTICLES BY POTENTIALS V(r) AND AMPLITUDES OF MULTICHANNEL PROCESSES. Gur'yanov, V. S. (Saratov State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 78-83(1973). (In Russian).

The functionals permitting the bilateral evaluation of the real and imaginary parts of particle scattering amplitudes by non-spherical potentials and the amplitudes of multichannel processes were examined. In order to decrease the interval between the two evaluations the use of Schwinger iteration of the trial functions is proposed. The multiparticle generalization of these functions makes it possible to evaluate the error of the approximation of the P-bound channels and the approximation definition of the wave function and the energy of internal motion. (tr-auth)

11273 COMPLEMENTARY WAY FOR RECONSTRUCTING POTENTIAL CURVES IN THE ZERO APPROXIMATION OF A GENERALIZED WKB METHOD. Vasilevskaya, L. I.; Basilevskii, A. S. (Kirov Pedagogical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 127-129(1973). (In Russian).

It was established that the problem on the reconstruction of potential curves from the oscillation-rotational energy conditions in the zero approximation of the generalized WKB method permits a new method of solution different from that proposed earlier. (tr-auth)

11274 SOLUTION OF THE UNITARITY CONDITION FOR AMPLITUDES OF TWO-PARTICLE PROCESSES. Azimov, S. A.; Arushanov, G. G. (Tashkent State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 108-114(1973). (In Russian).

The unitarity equation for the amplitudes of random two-particle inelastic processes is solved. It was shown that some previously announced results following from the hypothesis of isotopic invariance or from the hypothesis of vector dominance are partial cases of the solution obtained. (tr-auth)

11275 COMPLETELY UNITARY MULTIPARTICLE MODELS. Lam, C.S. (National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. D 9: No. 1, 296-301 (1 Jan 1974).

A class of completely unitary multiparticle models is studied. This class is defined by an effective Hamiltonian which allows direct transitions only between two- and $n(\geq 2)$ -particle states. The nonzero matrix elements, however, are completely arbitrary. Unitarity-constrained elastic and production amplitudes can be solved exactly and expressed in simple closed forms. It turns out that the absorption functions for the real part of the elastic amplitude, for the imaginary part, and for the production amplitudes are all different. Moreover, alternate black and transparent zones of interaction may develop if the interaction strength is sufficiently strong. (auth)

11276 SIMPLE CALCULATION OF WIGNER ROTATIONS AS FUNCTIONS OF S AND T. Applications to Scattering and Crossing. Gomatam, D.; O'Raiferti, L. S.; Chrak'yan, T. Ya. (Inst. of High Energy Research, Serpukhov, USSR). Teor. Mat. Fiz.; 19: No. 2, 201-207(May 1974). (In Russian).

A simple inspectional method of calculating Wigner rotations for coplanar processes as functions of s and t is presented. The method is applied to two-body scattering and crossing, and in the latter case extends the results of Trueman and Wick to arbitrary frames. The method is not restricted to helicity quantization, but helicity quantization turns out to play a central role. (auth)

11277 SPECTRAL ANALYSIS OF RELATIVISTIC HAMILTONIANS. Weder, R. A. Louvain, Belgium; Univ. Louvain (1974). 104p. Centre d'Etudes de l'Energie Nucleaire, Mol, Belgium.

Thesis.

In relativistic quantum physics hamiltonians are in general pseudo-differential operators. The spectral analysis of these operators is developed. The spectral properties of the hamiltonian of a relativistic spin-zero particle in an external potential and of a system of 2 relativistic spin-zero particles in interaction are studied. It is proved that Dirac's hamiltonian for electric and magnetic potentials of Yukawa type is essentially selfadjoint on C_0^∞. Properties of resonances and eigenvalues embedded in the continuous spectrum are investigated. Finally the spectrum of the Lee model hamiltonian with Y-interaction is studied. (auth)

11278 COMMENTS ON THE ORDERING PROBLEM IN THE APPLICATION OF THE GLAUBER MULTIPLE-SCATTERING THEORY. Obu, M. (Nihon Univ., Tokyo). Progr. Theor. Phys. (Kyoto); 50: No. 6, 1958-1964(Dec 1973).

The validity of the usually adopted prescription for the ordering of the profile functions is discussed in the framework of the extended Glauber multiple-scattering theory which can describe inelastic excitations of the incident particles by nuclei. The essential condition is shown to be $a \ll R$, where a is a characteristic range of the interactions and R is the nuclear radius. It is pointed out that since in this case phase functions cannot simply be defined it would not be suitable to state that the additivity of the phase function yields the composition law for the profile function. (auth)

PHYSICS (LOW-TEMPERATURE)

Superfluidity

11279 (INIS-mf-1239) THERMAL EFFECTS IN ADIABATIC FLOW OF HELIUM II. Olijhoek, J. F. (Rijksuniversiteit Leiden (Netherlands)). 7 Nov 1973. 80p. INIS.

Measurements on the cooling effect that occurs when liquid He II is forced to flow through a system consisting of a superleak and a fine capillary in series are reported. The nature of this cooling process and the origin of a lower limit which occurs at about 0.75°K, independently of the initial conditions, are the subjects of the present research. In carrying out the experiments at temperatures below 0.75°K, no cooling was detected; instead a warming occurred from which we were able to calculate the dissipative energy rate. It is found that the "mutual friction" force plays an essential role in the cooling process and that cooling is most likely due to interaction between rotons and vortices. It is found, as expected, that the limiting temperature for cooling to about 0.75°K does indeed decrease with increasing overall pressure, occurring at a fixed roton density. The occurrence of this limit appears to be a complicated phenomenon, in which the roton density as well as dissipation by the flow, either in the chamber or in the capillary seem to play an essential role. In the present apparatus the velocities of the normal and superfluid components could be varied independently over a wide range of velocities, enabling us to study the nature of the all-important mutual friction force. It is found that a mutual friction force of the Gorter–Mellink type, i.e., $F_m = A\rho_s\rho_n(v_s - v_n)^3$ gives an adequate description of the behavior of the chamber temperature at sufficiently low velocities. Extending previous investigations on the cooling effect, the temperature distribution along the thermally isolated capillary is measured. The temperature gradient at the entrance of the capillary is found to be numerically compatible with the earlier suggestion that heat conduction imposes a limit for cooling. The present results for low velocities appear not to be in agreement with the Gorter–Mellink model. At high velocities the temperature distribution becomes independent of the bath temperature along the almost entire length of the capillary. From thermodynamics it is shown that the energy dissipated in the capillary is carried away by convective heat transport only, the velocity of the normal component at the end of the capillary being equal to the total mass flow velocity v. (auth)

11280 SUPERFLUID DENSITY OF ANISOTROPIC SUPERFLUID. Takagi, S. (Tokyo Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 2, 635-637(Feb 1974).

11281 PROPAGATION OF ZERO SOUND IN AN ANISOTROPIC SUPERFLUID STATE OF ^{3}He. Ebisawa, H. (Tohoku Univ., Sendai); Maki, K. Progr. Theor. Phys. (Kyoto); 51: No. 2, 337-356(Feb 1974).

Propagation of the zero sound in a superfluid state of ^{3}He is studied theoretically. Limited to an anisotropic superfluid state with spin triplet pairing of the type suggested by Anderson and Brinkman, the attenuation coefficient and the shift in the sound velocity in the superfluid state is calculated. The results appear to reproduce at least qualitatively the experimental observation by Lawson et al., and by Paulson et al. (auth)

11282 SUPERFLUID PHASES OF LIQUID ^{3}He. Soda, T.; Yamazaki, K. (Tokyo Univ. of Education). Progr. Theor. Phys. (Kyoto); 51: No. 2, 327-336(Feb 1974).

Thermodynamic and magnetic properties of superfluid ^{3}He are investigated to give a consistent explanation for recent experiments on the superfluid ^{3}He under the hypothesis that liquid ^{3}He undergoes a second order phase transition to the F state pairing of superfluid at $T_A = 2.65$ mK and makes a first order transition to the D state pairing at $T_B = 2.0$ mK. (auth)

11283 REMARK ON THE EXPRESSION FOR THE ENERGY CURRENT IN He(II)–^{3}He MIXTURES. Szprynger, A. (Inst. for Low Temperature and Structure Research, Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci., Math., Astron. Phys.; 22: No. 2, 171-174 (Feb 1974).

Starting from the equilibrium conditions, an expression for the energy current in superfluid He-II and He-II–^{3}He mixtures is derived in the frame of reference resting with the normal component. (auth)

11284 SOURCES OF PARTICLES IN THE HAMILTONIAN DESCRIBING A SUPERFLUID. I. Examination of the Real Part of the Sources. Galasiewicz, Z. M. (Univ., Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci., Math., Astron. Phys.; 22: No. 2, 189-195(Feb 1974).

It is demonstrated that the assumption about the smallness of the real part of the "sources of particles" is not well grounded. Only in the presence of the real part of sources in the hydrodynamic equations is the correct calculation of the one-particle Green functions for superfluid systems possible. When temp. $\theta \to 0°$, a new singularity of form $1/\theta^6$ is discovered for these functions. (auth)

11285 SOURCES OF PARTICLES IN THE HAMILTONIAN DESCRIBING A SUPERFLUID. II. Density of Condensate: Density of Particles Dependence. Galasiewicz, Z. M. (Univ., Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci., Math., Astron. Phys.; 22: No. 2, 197-201(Feb 1974).

It is demonstrated that from the connection between retarded and advanced Green functions one can find, for equilibrium, explicit dependence of the density of condensate on the density of Bose particles. (auth)

11286 SOURCES OF PARTICLES IN THE HAMILTONIAN DESCRIBING A SUPERFLUID. III. Behavior Under the Time Inversion. Galasiewicz, Z. M. (Univ., Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci., Math., Astron. Phys.; 22: No. 2, 203-205 (Feb 1974).

It is demonstrated that the imaginary part of the "sources of particles" behaves like a pseudoscalar under the time inversion. According to this the source-dependence of dissipative terms in the hydrodynamical equations for a superfluid is reexamined. (auth)

11287 TWO-DIMENSIONAL ROTONS. Padmore, T.C. (Department of Physics, Erindale College, University of Toronto, Mississauga, Ontario, Canada). Phys. Rev. Lett. 32: No. 15, 826-829 (15 Apr 1974).

A Monte Carlo calculation of the Feynman–Cohen excitation spectrum is performed for helium confined to two dimensions. No approximations are used. Results for several different areal densities are compared with an exactly similar calculation in three dimensions. Among other results the roton gap is found to be significantly lower at corresponding densities in two dimensions, much smaller than previous estimates, and in substantial agreement with experiment. (auth)

11288 THERMAL EFFICIENCY OF A PUMPED SUPERCRITICAL HELIUM REFRIGERATION SYSTEM OPERATING BELOW 6 K. Dean, J. W. (Brookhaven National Lab., Upton, NY). Cryogenics; 14: No. 6, 307-312(Jun 1974).

The thermal efficiency of a pumped supercritical helium refrigeration system is calculated as a function of the heat load operating temperature and the supercritical helium pressure. The increase in the compressor power requirement caused by the pump operation over the compressor power required for a 4.5 K liquid helium refrigerator is presented. The use of reciprocating pumps is favored over a centrifugal pump because of lower losses and its capability to operate at higher temperature during cooldown. (auth)

Superconductivity

Refer also to abstract 9413.

11289 (AD-771911) SUPERCONDUCTIVITY IN ONE- AND TWO-DIMENSIONAL SYSTEMS. Final Report, October 1971–September 1972. Fredericks, G. E. (Texas Univ., Austin (USA)). 1 Sep 1973. Contract DAAK02-72-C-0044. 28p. NTIS $3.50.

An investigation of superconductivity with particular emphasis on systems which may be analyzed in terms of one and two dimensional models is reported. In particular, the mixed crystal system Nb(x)Mo(1-x)S2 was studied, experimentally. In addition a simple theoretical model was developed to account for the increase in the superconducting transition temperature in layered compounds as the number of layers is increased. (auth)

11290 (INIS-mf-1298) INDUCED CHARGE TRANSPORT IN NIOBIUM AND TIN AT LOW TEMPERATURES. van de Klundert, L. J. M. (Technische Hogeschool Twente, Enschede (Netherlands). Afdeling Technische Natuurkunde). 15 Jun 1972. 105p. INIS.

The processes involved in induced charge transport in metals were studied both from a theoretical and from an experimental point of view. The distribution of the eddy currents in the normal conducting state was reconsidered with respect to the boundary scattering in cylindrical specimens. An equation which can be solved numerically was derived under the conditions of spherical

Fermi surface and diffuse boundary reflection for the free conduction electrons. The experimental techniques, known from the literature, were reconsidered and equipment with improved sensitivity and frequency range was constructed. Two additional features providing the detection of higher harmonics in the output signal of the pick-up coils due to the nonlinear response of the samples and the direct observation of the local b-h loops were incorporated in the equipment. At liquid helium temperatures the behavior of metals showing superconductivity may be of great technical importance. The experiments were performed on cylindrical samples of tin and niobium. In this way effects characteristic for both classes of superconductors could be observed. For each metal several samples were used in the experiments to investigate the influence of the crystalline state of the materials. The experiments were performed both in the superconducting and in the normal conductive regions. With tin the large effects due to the surface scattering and the large mean free path of the electrons were detected. A satisfactory description using calculations valid for flat surfaces could be given. The measurements on niobium confirmed some results reported in the literature. A qualitative model based on the fluxline motion in the mixed state and the surface-superconducting state has been presented for the explanation of the observed amplitude and frequency dependence. (auth)

11291 (INIS-mf-1302) TUNNELING EXPERIMENTS WITH SUPERCONDUCTORS. Bakker, J. W. M. (Katholieke Universiteit Nijmegen (Netherlands)). 25 Oct 1973. 168p. INIS.

Superconducting tunnel junctions have been used in many experiments and have mainly led to the belief that the BCS theory in its more elaborate form, is able to describe the experimental results with an accuracy which is better than 1%. These junctions consist of a three-layer structure: a superconductor (S) – isolating layer – and a metal, which can be normal (N) or superconducting (S). Some promising properties of SS and SN junctions are investigated. The tunneling effect is explained with the aid of simple semiconductor diagrams. A more theoretical formalism, based on a tunneling Hamiltonian and first-order perturbation theory, leads to the same result as the simple model. Some specific cases have been evaluated and computer calculations are presented, so that one can predict the behavior of a specific junction in terms of the relevant parameters (temperature, energy gap). The results of the BCS theory are part of the assumptions in the calculations. The applicability of SN and SS junctions as absolute thermometers is investigated in the temperature range 0.1 T_c to T_c, T_c being critical temperature of the superconductor. We show that the "BCS" thermomenter has many interesting properties: a fast response time ($<10^{-6}$ s), a minimum amount of dissipated power (10^{-12} Watt at 1 K) and a high sensitivity. Superconducting SS junctions can be used as generators and detectors of incoherent, monochromatic phonons with a frequency corresponding to the energy gap (for tin: $2\Delta \approx 300$ GHz). The practical applicability is investigated by means of phonon transmission through sapphire and ruby. Apart from the use of SS junctions as quantum detectors, they can also be used as bolometers. The propagation of shock waves through helium gas is investigated with the same experimental techniques. Finally, a proposal is made to do a real spectroscopic experiment in KCl doped with a small amount of ^{6}Li. (auth)

11292 (JUL-987-FF) SUPERCONDUCTIVITY OF PALLADIUM AND Pd–Ag ALLOYS AFTER ION IMPLANTATION OF HYDROGEN AND DEUTERIUM. Stritzker, B. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Festkoerperforschung). Aug 1973. 56p. (In German). Dep. NTIS (US Sales Only) $6.00.

Thesis. Submitted to Karlsruhe Univ. (West Germany).

The method of producing alloys of nearly any composition with the aid of ion implantation into a target with liquid helium temperature has been used to increase the H-concentration in Pd beyond the ratio achieved up to now, and thus to study its influence on the superconductivity in the Pd–H system. These experiments have been extended to the Pd–Ag–H system and the dependence of the transition temperature on the Ag-concentration has been measured. By substituting H-atoms by deuterium the mass influence could be studied. (GE)

11293 (N-74-15434) EXPERIMENTAL INVESTIGATION OF THE CRITICAL MAGNETIC FIELDS OF TRANSITION METAL SUPERCONDUCTORS. Final Report, 1 June 1972–31 May 1973. McEvoy, J. P. (Clark Univ., Worcester, Mass. (USA). Dept. of Physics). 31 May 1973. Contract NAS8-28900. 52p. (NASA-CR-120127). NTIS $4.75.

The isothermal magnetic transitions of a Type II superconductor have been studied by ac susceptibility techniques as a function of the amplitude and frequency of the exciting field. The field variation of the complex susceptibility was used to determine the critical fields. The research was planned to clarify the determination (both experimentally and theoretically) of the maximum field at which the superconductive phase spontaneously nucleates in the bulk and on the surface of the metal. (auth) (STAR)

11294 DEPENDENCE OF FLUX FLOW VOLTAGES ON FIELD PROFILE IN TYPE II SUPERCONDUCTORS. Khanna, S. M.; LeBlanc, M. A. R. (Univ. of Ottawa). J. Phys., F (London); 4: No. 4, 550-562(Apr 1974).

The integrated voltages observed across an open single layer superconducting coil when its magnetization is thermally destroyed by rapid heating at the inner (or outer) surface depend on (i) the initial temperature, (ii) the applied magnetic field and (iii) the diamagnetic, paramagnetic or hybrid nature of the initial magnetization. The signals, normalized to the initial magnetic moments, are also seen to increase as the initial moment decreases with all the curves approaching a common extremum value in the limit of infinitesimal moment. Exploiting critical state concepts together with the viewpoint that the observed voltages are produced only by the change of magnetic flux embraced by the measuring circuit excluding the volume of the superconductor, all of the observations are accounted for. It is proposed that the width of the plateau in the initial configuration of the field profile plays the major role in determining the fraction of flux created (or destroyed) at the heated surface upon rapid asymmetric heating to the normal state. (auth)

11295 SUPERCONDUCTOR WITH LAYER OF THE A15-PHASE Nb–Al(Ge). Mueller, A. (Siemens AG, Erlangen, Ger.). Z. Naturforsch.; 29A: No. 1, 99-106(Jan 1974). (In German).

A conductor has been prepared, consisting of niobium and an outer layer of the A15-phase Nb–Al and Nb–Al–Ge respectively. The process involves two steps: Coating of niobium by hot-dipping and subsequent heat treatment. The procedure, the products of reaction and data on the transition temperature T_c and the critical current density J_c of the A15-phase are reported. The maximum values obtained for T_c and J_c are 18.5 K (19.3 K) and 5×10^4 A/cm^2 (2×10^4 A/cm^2) at 5 T and 4.2 K for Nb_3Al (Nb_3Al,Ge). (GE)

11296 ENERGY SPECTRUM OF TRANSITION METALS IN THE SUPERCONDUCTING STATE. Fal'ko, I. I.; Fal'ko, V. L. (Kharkov State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 6, 20-24(1973). (In Russian).

It was shown that in pure transition metals even a small probability of interzone Cooper coupling leads to the formation of an energy spectrum consisting of two branches, each of which has several maxima and minima. (tr-auth)

11297 METALLIC HYDROGEN. Dupas, C. Recherche (Paris); 4: 888-892(Oct 1973). (In French).

An outline of the history of the metallic hydrogen concept is presented, along with a brief review of the theoretical predictions and experimental investigation attempts prompted by this concept. The possible superconductivity of metallic hydrogen at relatively high temperatures suggested by theoretical considerations is discussed, and recent Soviet and American hydrogen compression experiments with pressure goals of Mbar magnitude, are described. The likelihood of metallic hydrogen stability at ordinary (1 atm) sea-level pressure is considered, as well as the numerous important applications this should make possible. The potential role of metallic hydrogen in the structure of the outer planets and space probes to aid its investigation are also reviewed. (IAA)

11298 SEARCH FOR LOCALIZED PHONON MODES IN LEAD-BASED ALLOYS BY SUPERCONDUCTING TUNNELING. Granqvist, C. G.; Claeson, T. (Chalmers Tekniska Hoegskola, Goteborg). J. Phys. Chem. Solids; 5: No. 6, 711-715(Jun 1974).

To investigate the appearance of localized phonon modes, superconductive tunneling was performed into films of $Pb_{0.9}M_{0.1}$ (M = Ag, Cd, Ga, Ge, In, Mg, Na, Sb, Sn, Te, Zn) and $Pb_{0.97}Sn_{0.03}$. The films were quench-condensed and later annealed at 30, 100 and 300°K. Structure in tunneling curves resulting from localized phonons was observed only for a well annealed In alloy film. For most of the impurities an absence of observable local phonon modes could be explained as due to a lack of solid solubility or of sufficient structural order in the film. For Na and Sn alloys, however, these arguments cannot be used. No modes could be seen for such alloys even in films condensed at room temperature, heat-treated slightly, and quenched directly into liquid helium. (auth)

11299 Nb_3Ga BASE SUPERCONDUCTING MATERIALS. Kawabe, U.; Kudo, M.; Fukase, S. (to Hitachi, Ltd.). US Patent 3,801,313. 2 Apr 1974. Priority date 20 May 1971, Japan. 10p.

A superconducting material is described having a critical temperature higher by 3° to 5°K than that of and a critical current

density several times higher than that of Nb_3Ga provided by replacing a part of atoms in the Ga sites of Nb_3Ga with atoms of one of Al, Mn, Sb, and Y and, when required, replacing a part of atoms in the Nb sites with Ta atoms and by subjecting this intermetallic compound to an aging process at 800°C for 300 hours. This material has a β-W type crystal structure similar to Nb_3Ga. (auth)

11300 EXACT SOLUTION OF A NEW SUPERCONDUCTING STATE. Fink, H.J.; Poulsen, R.S. (Department of Electrical Engineering, University of California, Davis, California 95616). Phys. Rev. Lett. 32: No. 14, 762-765 (8 Apr 1974).

An exact solution of a new superconducting state is obtained which exists for dc currents larger than the critical current in thin wires. The order parameter is zero at all times at certain points in the whisker, thereby permitting the phase to slip at a constant rate, a consequence of which is a dc potential difference between the separate singly connected superconducting regions. These solutions are periodic in space and stable in time and lead to voltage steps in the dc V-I characteristic. (auth)

11301 DIRECT OBSERVATION OF ENHANCED LATTICE STABILITY IN V_3Si UNDER HYDROSTATIC PRESSURE. Chu, C.W. (Department of Physics, Cleveland State University, Cleveland, Ohio 44115 and Bell Laboratories, Murray Hill, New Jersey 07974); Testardi, L.R. Phys. Rev. Lett. 32: No. 14, 766-769 (8 Apr 1974).

The lattice transformation temperature T_L of single-crystal V_3Si was directly observed to decrease linearly with hydrostatic pressure at a rate of $-(1.5 \pm 0.1) \times 10^{-4}$ °K bar^{-1}. To explain the pressure dependence of T_L and the elastic behavior, the Labbé-Friedel model must be extended to include interband charge-transfer effects as a new variable, in agreement with a recent calculation of Ting and Ganguly. We give a discussion of these results related to structural instability and superconductivity. (auth)

11302 LOSSES IN LAMINAR COMPOSITE Nb_3Sn AT 60 Hz. Snowden, D.P. (Intelcom Rad Tech, P. O. Box 80817, San Diego, California 92138); Meyer, C.H. Jr.; Sterling, S.A. J. Appl. Phys. 45: No. 6, 2693-2699 (June 1974).

A detailed study has been made of the ac loss in cylindrical samples of Nb_3Sn carrying a transport current at 60 Hz. Samples were prepared by a vacuum codeposition process. At low currents, up to 550 A/cm at 4.2 °K in some samples, the loss is dominated by a surface fluxoid pinning mechanism, varies no faster than the square of the current, and in many cases less rapidly, and is temperature independent. At higher currents, the loss is described by the critical-state model. Formation of the superconductor in cylindrical layers separated by another material provides enhanced bulk fluxoid pinning, thereby increasing the critical current density and decreasing the loss at high currents. The magnitude of the ac loss in this material up to 10-12 °K is comparable to that reported in niobium at 4.2 °K (auth)

11303 SUPERCONDUCTIVE TUNNELING IN JUNCTIONS CONTAINING LEAD-GOLD LAYERED FILMS. Basavaiah, S.; Lahiri, S.K. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598). J. Appl. Phys. 45: No. 6, 2773-2774 (June 1974).

Tunneling between lead-gold layered films separated by an oxide barrier has been investigated. From these results, the superconducting transition temperature and the energy gap of the compound, $AuPb_3$, present in these films have been deduced. (auth)

11304 EFFECTS OF LOW-TEMPERATURE FAST-NEUTRON IRRADIATION ON AC LOSSES IN NbTi. Brown, B.S.; Freyhardt, H.C.; Blewitt, T.H. (Argonne National Laboratory, Argonne, Illinois 60439). J. Appl. Phys. 45: No. 6, 2724-2727 (June 1974).

The complex magnetic permeability of Nb-44 at.% Ti has been measured using a modified Hartshorn ac bridge and a lock-in amplifier. The out-of-phase signal can be directly related to the energy losses, and critical current can be calculated using the Bean model. Samples were irradiated in a fission neutron spectrum to a dose of 3.2×10^{18} neutron/cm^2. All measurements were taken in situ at approximately 4.5 °K in an external magnetic field continuously swept to 6.7 kOe while applying ac magnetic fields at 88 Hz with amplitudes between 8 and 500 Oe. Irradiations and measurements were performed on an annealed and a cold-worked sample of the alloy. For the annealed sample, no changes were observed in V_L and thus in J_c after 8.2×10^{17} neutron/cm^2 and after an anneal to 320 °K. A decrease of approximately 8% was observed in J_c for the cold-worked sample after 3.2×10^{18} neutron/cm^2. One-half of this decrease was recovered by 270 °K. (auth)

11305 ZERO-BIAS ANOMALY IN GaAs/Mo TUNNEL JUNCTIONS. Sood, B.R.; Pak, Y.L. (Department of Physics, Case Western Reserve University, Cleveland, Ohio 44106). J. Appl. Phys. 45: No. 6, 2579-2581 (June 1974).

A large zero-bias anomaly has been observed in the point contact tunnel junctions made between a degenerate p-type GaAs and Mo. The anomaly corresponds to a resistance peak centered at zero bias. The junction resistance at zero bias is a strong function of temperature, increasing with decreasing temperature. A quantitative study of the voltage and temperature dependence of the zero-bias anomaly has been made. No effect of the magnetic field up to 12 kG was found. When the temperature was lowered below the transition temperature of Mo, the superconducting energy gap of Mo was observed, which indicated that the mechanism of current flow is by electron tunneling. (auth)

11306 DIFFUSION EFFECTS IN MAGNETIC INSTABILITIES IN SUPERCONDUCTORS OF THE SECOND KIND. Mailfert, A.; Boyer, L. (Laboratoire Central des Industries Electriques, Fontenay-aux-Roses, France). Rev. Phys. Appl.; 8: No. 4, 403-408(Dec 1973). (In French).

From third meeting on superconducting materials and applications of superconductivity; Aussois, France (4 Apr 1973).

A brief review is given of the flux jump phenomenon. The two diffusion mechanisms occurring were studied: heat diffusion and diffusion of magnetic induction. The various stabilization methods are described together with the corresponding criteria. The role played by the flux flow conductivity in the instability triggering mechanism is then discussed. (FR)

11307 SUPERCONDUCTIVITY. Series I. Riverdale, MD; Cambridge Scientific Abstracts, Inc. (1973). 139p.

The 1495 abstracts included are presented under the subject headings: general, theory and analysis, energy gap and electronic structure, magnetization and transitions, magnetic flux and conduction, superconducting junctions and structures, elastic and thermal properties of superconductors, and resonance in superconductors. Also included are a subject index, a material index, an author index, and a source index. (MHR)

11308 DISCOVERY OF TUNNELING SUPERCURRENTS. Josephson, B. D. (Cambridge Univ., Eng.). Science; 184: No. 4136, 527-530(3 May 1974).

The history of the work on the tunnel effect which led to the Nobel prize is traced. The effect of Anderson's concept of broken symmetry in superconductors is discussed. (MHR)

11309 MAGNETIC STRUCTURES IN TYPE II SUPERCONDUCTORS WITH IMPURITIES. Tamura, Y.; Wada, Y. (Tokyo Univ.,). Progr. Theor. Phys. (Kyoto); 51: No. 1, 43-61(Jan 1974).

It is theoretically shown that in type-II superconductors with an arbitrary concentration of impurities a periodic lattice structure of flux lines exists in the whole region of the mixed state. This is a generalization of Usadel's remark, given in the dirty limit. Eilenberger's transport-like equations are used. The flux is shown to be always quantized. Symmetry properties make it possible to expand Eilenberger's functions, the order parameter and the magnetic field in a Fourier series with respect to spatial variation. Equations for the Fourier coefficients are derived. They are solved in two cases in the dirty limit. First, in the region close to H_{c2} where the order parameter is so small that the power series expansion is applicable. The well-known results by Maki are reproduced. Second, in a wider range of the mixed state, where one can derive Takayama and Maki's result by introducing an additional approximation. The approximation is found to be applicable except at very low temperatures. (auth)

11310 THEORY FOR TYPE II/1 SUPERCONDUCTORS. Leplae, L.; Srinivasan, V.; Umezawa, H. (Univ. of Wisconsin, Milwaukee). Lett. Nuovo Cim.; 9: No. 17, 711-715(27 Apr 1974).

It was previously shown that there appears experimentally an intermediate type of superconductors which share some characteristics of Type I and some of Type II. This new type of superconductors is called Type II/1, the notation Type II/2 is reserved for superconductors having the usual Type-II behavior. This calculation is based on the results of the boson formulation of the theory of superconductivity. It is found that beside quasi-electrons there appear quasi-bosons in the microscopic theory. It is also found that the various ground states in which a superconductor can be are controlled by the condensation of these bosons. (MHR)

11311 IRRADIATION EFFECTS IN BCC TYPE II SUPERCONDUCTORS. Ullmaier, H. (Institut fuer Festkoerperforschung der Kernforschungsanlage, Juelich, GE). Nucl. Met., Met. Soc. AIME; 18: 363-382(1973).

From conference on defects and defect clusters in bcc metals and their alloys; Gaithersburg, Maryland, USA (14 Aug 1973). See CONF-730813-.

In this short review an attempt is made to summarize the available data on the influence of fast particle irradiation on superconducting properties of bcc metals and alloys. In general, irradiation of pure superconducting metals (Nb, V) with increasing dose leads to a slight decrease in the transition temperature T_c, a linear increase in the upper critical field H_{c2}, and an increasing pinning of flux lines. All these effects are in at least qualitative agreement

with theory but more experiments are needed to understand all details of the influence of irradiation-produced defects (and defects in general) on superconductivity. A number of investigations on irradiated superconducting alloys (NbTi, NbZr) exist, yielding valuable information about the changes in critical current which are important for the applicability of these "hard superconductors" as materials for magnet coils in fusion machines and particle accelerators. However, the theoretical interpretation and physical understanding of these results are extremely difficult, mainly because of the complicated metallurgical structure of these alloys which compete and interact with the irradiation produced defect structure. (12 figures, 38 references) (auth)

11312 TABULATION OF THE BRT FUNCTION FOR THE THERMAL CONDUCTIVITY RATIO AND THE AG FUNCTION FOR THE DEPRESSION OF THE CRITICAL TEMPERATURE. Ramos, E. D.; Sanchez, D. H. (Buenos Aires Univ., Nacional). Cryogenics; 14: No. 6, 341-343(Jun 1974).

The electronic thermal conductivity of superconductors has been described by Barden et al (Phys. Rev.; 113: 982 (1959)) for the case where the electrons are scattered by ordinary impurities. Their result is a function for the ratio K_{es}/K_{en} of the thermal conductivities in the superconducting and normal states in terms of the parameter $y = \Delta(T)/k_BT$, where $\Delta(T)$ is the energy gap. This was calculated and tabulated by the present authors (copies available on request) and a short version of the tabulation is given here. The function Δ (T) has been calculated by Muhlschlegel (Z. Physik; 155: 313 (1959)) for the case discussed by Bardeen, Cooper and Schrieffer (Phy. Rev.; 108: 1175 (1957)). This table is reproduced and used to calculate K_{es}/K_{en} as a function of $t = T/T_C$ for some particular cases. The depression of the critical temperature (T_C) of a superconductor by magnetic impurities has been studied by Abrikosov and Gor'kov (Soviet Phys. JETP; 12: 1243 (1961)). These results are calculated and tabulated. (UK)

11313 MAGNETIC STRUCTURES AND DENSITY OF STATES IN TYPE-II SUPERCONDUCTORS WITH PARAMAGNETIC IMPURITIES. Tamura, Y. (Tokyo Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 1, 315-316(Jan 1974).

11314 ULTRASONIC ATTENUATION IN THE INTERMEDIATE STATE OF TIN. Chaudhuri, K. D.; Mahajan, S. K. (Delhi Univ.). Cryogenics; 14: No. 6, 321-322(Jun 1974).

Attenuation of ultrasound has been measured in the intermediate state of single crystals of tin at 3.3 MHz in the temperature range 1.5 to 3.7 K. A small measurable change of the frequency v_0 of the collective modes of excitations has been observed very near the critical magnetic field. (auth)

11315 EVIDENCE FOR INTERMEDIATE TEMPERATURE SUPERCONDUCTIVITY AS A BULK EFFECT. Steglich, F.; Armbruester, H. (Cologne Univ.). Solid State Commun.; 14: No. 10, 903-906(15 May 1974).

The specific heat was measured in a highly homogenized sample of $(La_{0.9936}Ce_{0.0064})Al_2$ between 0.35 and 1.5K, both in the superconducting and in the normal state. The difference of the specific heats $\Delta C = C_S - C_N$ was observed to change its sign twice. Hence the existence of an "intermediate temperature superconductor" is suggested by means of a true volume effect. Reasonable agreement is found between the conclusions from the specific heat experiment and recent results of Winzer (Winzer, K., Z. Phys. 265, 139 (1973)) obtained for the upper critical magnetic field. (auth)

11316 ANISOTROPIC HEAT CONDUCTION IN CUBIC SUPERCONDUCTORS AT VERY LOW TEMPERATURES. Winterheimer, C. G.; McCurdy, A. K. (Worchester Polytechnic Inst., MA). Solid State Commun.; 14: No. 10, 919-922(15 May 1974).

Anisotropic heat conduction is predicted in defect-free superconducting lead and niobium in the temperature range $T/T_c \ll 1$. This anisotropy is predicted to result from phonon focusing which is a general property of elastically anisotropic crystals. (auth)

11317 EFFECT OF SOFT PHONONS ON SUPERCONDUCTIVITY: A RE-EVALUATION AND A POSITIVE CASE FOR Nb_3Sn. Allen, P. B. (Cambridge Univ., Eng.). Solid State Commun.; 14: No. 10, 937-940(15 May 1974).

The effect of low frequency phonons on superconductivity (which was described as detrimental in a previous paper) is re-assessed following the work of Bergmann and Rainer (Bergmann, G. and Rainer, D., Z. Phys. (1973), 263, 59). An anomalously large positive contribution to T_c is quantitatively evaluated for soft phonons in Nb_3Sn using neutron data of Axe and Shirane (Axe, J. D. and Shirane, G., Phys. Rev. Lett. (1973), 30, 214; Phys. Rev. (1973) B8, 1965). Low frequency phonons appear helpful in raising T_c, but the coupling to high frequency phonons is of greater ultimate importance. (auth)

Equipment and Devices

11318 (IFVE-SEF-73-4) HYDROGEN-HELIUM TRANSPORT DEWAR OF 100-LITER CAPACITY WITHOUT NITROGEN COOLING. Borodin, G. I.; Vasil'ev, L. M.; Dmitrievskii, Yu. P.; Zhadkevich, A. L.; Kashtanov, E. M.; Mel'nik, Yu. M.; Prudkoglyad, A. F.; Sytnik, V. V.; Tushabramishvili, K. Z. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 7p. (In Russian). INIS.

A 100-liter Dewar vessel for liquid hydrogen and helium was constructed with thermal shielding by the evaporated gas. The vessel is distinguished by its simplicity of construction and low weight which assures the possibility of manual transport. The basic parameters are: weight of the empty vessel of 42.5 kg, evaporability of hydrogen of 0.6% per day, and of helium of 1.7% per day. (SJR)

11319 (LNF-73-55) RADIOFREQUENCY SUPERCONDUCTOR MAGNETOMETER. Balsamo, E. P.; Paterno, G.; Lucano, G.; Pace S.; Romani, G. L. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). 2 Nov 1973. 12p. (In Italian). Dep. NTIS (US Sales Only) $4.00.

A point-of-contact superconductor magnetometer was developed by the Frascati National Laboratory and the Institute of Physics of the University of Rome. A point-of-contact superconductor magnetometer or SQUID (superconducting quantum interference device) consists essentially of a superconducting cylinder interrupted by a weak link coupled to a resonating circuit at a frequency of about 20 MHz. The operating principles of this device are outlined. The circuit for the instrument, its operating characteristics, and its performance are described. The application of the device in the field of medicine, biophysics, and gravitational wave detection is indicated. (JSR)

11320 (NBS-TN-643) MEASUREMENT OF RF POWER AND ATTENUATION USING SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES. Kamper, R. A.; Simmonds, M. B.; Hoer, C. A.; Adair, R. T. (National Bureau of Standards, Boulder, Colo. (USA)). Aug 1973. 93p. GPO $1.00.

Two years' work on the superconducting quantum interference device (SQUID) for measurement of rf power and attenuation is reported. After an elementary exposition of the basic principles of the technique, the following are described: the SQUIDs themselves; the prototype systems developed to measure rf power and attenuation; systematic errors and fundamental limitations of the measurements that can be performed with them; and the obvious and immediate improvements that can be applied to them. An appendix is included for detailed drawings and instructions for fabrication of components. (MHR)

11321 (NIIEFA-B-168) DEVICE FOR PROTECTING SUPERCONDUCTING SOLENOIDS. Dubasov, V. G.; Emel'yanov, N. I.; Mymrikov, V. V.; Nesterov, V. V.; Trokhachev, G. V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1972. 8p. (In Russian). INIS.

A device is developed for protecting superconducting solenoids on transfer to a normal state. The circuit operates from a normal-phase signal of 1 to 2 MV in the presence of a background of pulse voltages (current jumps) of significantly higher value. The solenoid is cut off from the feed source 110 msec after appearance of the normal-phase signal. (SJR)

11322 SUPERCONDUCTING PROXIMITY EFFECT IN COPPER-LEAD SANDWICHES. Prothero, D. H. (Cambridge Univ., Eng.). Phil. Mag.; 29: No. 4, 829-846(Apr 1974).

Tunnelling measurements were made at temperatures of about 0.1K of the electronic densities of states on the copper side of copper-lead proximity sandwiches. The effect on the energy gap and density of states of varying the coupling between the copper and lead films and also of varying only the thickness of the lead film was investigated. In both cases the results were compared with the predictions of McMillan's theory (McMillan, W. L., 1968, Phys. Rev., 175, 537). The measurements of the energy gaps are in quantitative agreement with McMillan's predictions provided reasonable assumptions are made concerning the magnitude of the gap in the lead film. Some qualitative agreement also occurs concerning the form of the density of states, particularly in the most strongly decoupled specimens. Deviations from the theoretical predictions have also been observed. Experimental evidence is presented which confirms that the results were not significantly affected by intermetallic diffusion in the samples. (auth)

11323 IMPROVEMENTS RELATING TO ELECTRICAL CONDUCTORS. Caslaw, J. S. (to Plessey Co. Ltd.). British Patent 1,342,726. 3 Jan 1974. Filed Date 4 Feb 1970. 8p.

A superconducting conductor is described comprising Nb, Sn and Cu a small percentage of at least one metal selected from Zr, Al, Hf, Ti and V. The Cu may be diffused into the surface, and enables speedy attainment of the superconducting region. A method of increasing the current density of the conductor in a given magnetic field is also provided. The Cu may increase the current density or critical current of the conductor for a given magnetic field up to about twice. Where the Cu is supplied to the conductor by passing the Nb through a melt of Sn and Cu improved wetting of the Nb may result and a more even layer of Nb and Sn obtained. The conductor may have an O_2 content up to, say, 1,000 to 4,000 parts per million; this speeds up formation of the superconducting layer containing the Cu, but too much O_2 leads to brittleness. The Nb preferably contains Zr up to 1% to 5% by weight of the sum total of all the metals in the conductor. The conductor is preferably formed as or on wire tape. The Sn and Cu may be deposited on to Nb wire or tape, which is then passed into a furnace; or preferably the Sn and Cu are deposited by passing the wire or tape through a melt of Sn and Cu. Alternatively the Sn and Cu may be deposited separately on to the Nb wire or tape by plating. Electrolytic or chemical processes may also be used. A stainless steel reinforcing substrate is preferably provided. Other ways for introducing the Cu are also described, such as by sintering, plasma spraying or electroforming. The O_2 content may be introduced by incorporation in at least one of the constituent metals, or by heating in a gaseous atmosphere containing O_2, or by electrolytic oxidation. (UK)

11324 JOSEPHSON FREQUENCY CONVERSION IN THE RANGE 145–1600 GHz WITH Nb–Nb SUPERCONDUCTING POINT CONTACTS USED AS OSCILLATOR–MIXER. Vernet, G.; Adde, R. (Institut d'Electronique Fondamentale, Laboratoire Associé au C.N.R.S., Bâtiment 220, Université Paris XI, 91405 Orsay, France). J. Appl. Phys. 45: No. 6, 2678-2688 (June 1974).

The Josephson frequency conversion in the millimeter and submillimeter wave region is studied with superconducting Nb–Nb point-contact junctions at 4.2 °K, using the contact both as the local oscillator and the mixer with intermediate frequencies of 0.1, 0.3, and 9.2 GHz. The point contact is in a nonresonant structure and fed by a constant current source: neither a strong rf coupling of the contact with a cavity nor a stabilizing shunt resistance was proved necessary. The direct observation of frequency conversion was performed with a microwave receiver at 9.2 GHz in a range of Josephson frequencies between 145 and 1600 GHz. The experiments with intermediate frequencies f_i of 0.1 and 0.3 GHz indicate that conventional frequency conversion does not occur but that the observed signals are related to noise effects. An analysis of the frequency conversion mechanism in a Josephson junction operated as an oscillator–mixer is proposed which includes the noise effects and also the feedback effects induced in a junction driven by a constant current source. The results show that low-frequency current components are induced in the junction, which can give large spurious signals when small i.f. are used. (auth)

11325 NIOBIUM–GALLIUM SUPERCONDUCTOR. Webb, G. W. (to RCA Corp.). US Patent 3,801,378. 2 Apr 1974. Filed date 7 Feb 1972. 4p.

A superconducting alloy is described having a T_c of ≥ 20°K consists of a β-W alloy of Nb and Ga having the molar formula Nb_3Ga. The alloy can be formed by annealing a β-W phase Nb–Ga alloy at 700°C. (auth)

11326 GAIN IN A JOSEPHSON JUNCTION. Matisoo, J. (to General Instrument Corp.). US Patent 3,803,459. 9 Apr 1974. Filed date 27 Apr 1973. 8p.

The Josephson junction, which can be used as a superconductive switching element, comprises two metal superconductors that are separated by a barrier which can be the oxide of one of the metals. It has been found that current gains in such a junction can be greatly enhanced when the ratio of the penetration depth Λ_J of the junction to the length L of the junction is $<<1$. (auth)

11327 SUPERCONDUCTOR. Koch, C. C.; Love, G. R. (to United States Atomic Energy Commission). US Patent 3,805,119. 16 Apr 1974. Filed date 12 Jul 1972. 6p.

A superconductive niobium alloy having the property in the super-conducting state of remaining high-Q in appreciable dc magnetic fields, and a method for making the same are described. The alloy consists essentially of niobium metal and an additive metal dispersed as a second phase therein. The additive metal is gadolinium, yttrium, or a member of the lanthanum series of rare-earth metals. (auth)

11328 CRYOGENIC FLUID MECHANICS. Liepmann, H. W. (California Inst. of Tech., Pasadena). pp 1-10 of Recent Developments in Shock Tube Research. Stanford, CA; Stanford University Press (1973).

From 9th International symposium; Stanford, CA (16 Jul 1973).

The design, construction and performance of a shock tube with a cryogenically cooled test section is described. The shock tube is capable of producing M = 40 shock waves in helium. A specific application of the tube to shock wave motion in liquid He II is shown and the applicability of the device to some other problems in low temperature physics is sketched. (auth)

11329 MATERIAL SELECTION FOR THE TORQUE TUBES OF LARGE SUPERCONDUCTING ROTATING MACHINERY. Bejan, A. (Massachusetts Inst. of Tech., Cambridge). Cryogenics; 14: No. 6, 313-315(Jun 1974).

Properties to be considered when selecting materials used in construction of torque tubes for rotating superconducting field windings in electrical machinery are identified. The main design requirements are stated and the groups of material properties that influence directly the mechanical and thermal performance of a torque tube are derived. Most desirable is a low thermal conductivity to modulus of elasticity ratio which governs the refrigeration expense and the tube wall aspect ratio (thickness/length). Numerical examples point out that fibre-reinforced plastics are potential candidates for use in torque tubes. (auth)

11330 TRANSFORMER FOR MEASURING 60 Hz LOSS AND CRITICAL CURRENT CHARACTERISTICS OF SHORT SUPERCONDUCTOR TAPES. Forsyth, E. B.; Morgan, G. H. (Brookhaven National Lab., Upton, NY). Cryogenics; 14: No. 6, 316-320(Jun 1974).

To test samples of superconducting tape destined for use in power transmission cables, it is necessary to simulate the actual operating conditions for these cables. A transformer in which the field parallel to one side of the superconducting sample is provided by cylindrical iron poles, produces these conditions quickly and efficiently. The design of this transformer is described together with the actual measurement techniques used to assess the performance of samples. (auth)

11331 128 G 65.5 mm BORE SUPERCONDUCTING SOLENOID. Stevenson, R. (Canada Superconductor and Cyrogenics Co. Ltd., Quebec). Cryogenics; 14: No. 6, 329-331(Jun 1974).

The design, construction, and testing of commercial small high field superconducting magnets is described. A niobium-tin layer-wound solenoid with a 65.5 mm bore is used to give an example of practical applications of these techniques. (auth)

11332 OPTIMIZATION OF CURRENT LEADS FOR SUPERCONDUCTING SYSTEMS. Grassman, P.; von Hoffman, T. (Eidegenoessische Technische, Hochschule, Zurich). Cryogenics; 14: No. 6, 349-351(Jun 1974).

The rods connecting a power supply system at ambient temperature with a superconducting system are in many cases the main cause of losses. Thus, for a superconducting transformer more than 50% of the refrigeration load is consumed by the thermal conductivity of the connecting leads and the Joule heating generated in them. This note is a report of a thesis by Rauh ("Die optimalen Dimensionen elektrischer Zuleitungen fur Tieftemperaturanlagen," ETH-Zurich, Dissertation No. 4656. Available on request.) in which the temperature profiles and the minimal losses within such connecting rods are calculated. (UK)

11333 LOSSES IN TUBULAR SUPERCONDUCTING COMPOSITES WITH ANISOTROPIC SURFACE STRUCTURE. Carter, C. N.; Male, J. C.; Graeme-Barber, C. (Central Electricity Research Labs., Leatherhead, United Kingdom). Cryogenics; 14: No. 6, 332-339(Jun 1974).

AC losses have been measured in prototype tubular composite conductors of a design proposed for superconducting ac power transmission lines. The conductors were of 15 and 19 mm diameter, with a niobium surface layer bonded to a copper substrate either directly or via an intermediate layer of niobium–titanium alloy. At a surface current density appropriate for the working conditions of a power transmission line (40 A mm^{-1}) the losses measured for current flow in the axial or circumferential directions differed by up to an order of magnitude, depending on details of the surface anisotropy of each sample. For purely topological anisotropy, manifest in practice as longitudinal corrugations, circumferential currents gave the lower losses. For largely compositional anisotropy, such as longitudinal welds or strips of degraded surface material, circumferential currents gave the greater losses. These results have been interpreted in terms of the surface current distribution in each case. (auth)

PHYSICS (NUCLEAR)

11334 (MATSCIENCE-78) PROCEEDINGS OF THE CONFERENCE ON NUCLEAR PHYSICS HELD AT INSTITUTION OF ENGINEERS, MYSORE, INDIA, MARCH 1–4, 1973. Srinivasa Rao, K. (ed.). (Institute of Mathematical Sciences, Madras (India)). [nd]. 296p. (CONF-730354-). Inst. of Mathematical Sciences, Madras $1.00.

Separate abstracts were prepared for 22 papers. (JFP)

For abstracts of individual papers see: 9374, 10910, 11051–11053, 11094, 11142, 11225, 11383–11388, 11416, 11448, 11490, and 11603–11607.

Neutron Interactions with Matter

Refer also to abstracts 11048, 11491, 11582, 11660, 11711, 11994, 11998, and 12000.

11335 (AD-771091) SAMCEP CODE WITH BOUNDED FLUX AT A POINT ESTIMATION. Final Report. Lichtenstein, H.; Steinberg, H. (Mathematical Applications Group, Inc., Elmsford, N. Y. (USA)). Jun 1973. Contract DAAD05-73-C-0072. 190p. (MR-7036-P-7045; BRL-CR-109). NTIS $5.25.

SAMCEP is a system of U. S. A.-Standard FORTRAN programs for the solution by Monte Carlo of several correlated neutron transport problems in complex three-dimensional geometries. Up to 10 correlated problems, involving up to 100 perturbations, of composition, neutron cross sections, angular or energy distributions, and/or source spectra can be run simultaneously. Individual problem fluxes or doses (region-, energy-, and (on option) time-dependent), as well as the differences between those of any or all pairs of problems, are available. In addition, fluxes can be obtained at point detectors, with a built-in biasing procedure to bound the estimates, the so-called bounded flux-at-a-point (BEAP) estimation procedure. SAMCEP retains essentially all the features of its predecessor code, SAM-CE, including the use of basic neutron data in the latest ENDF/B format. (GRA)

11336 (AEEW-M-1266) MINIGAL: OUTPUT FROM THE FISSION PRODUCTS DATA FILES OF THE UK NUCLEAR DATA LIBRARY (1973)–THERMAL CROSS-SECTIONS, RESONANCE INTEGRALS AND FISSION SPECTRUM AVERAGES. Pope, A. L. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Apr 1974. 72p. Dep. NTIS (US Sales Only) $6.75.

The fission-product (and related) data files available in the UKNDL are summarised. The separate reactions and the energy range over which the data are tabulated are listed. Where relevant, the 2200 m/s cross section is given together with three integral parameters. These are helpful to the formation of a quick assessment of relative merits if there are different files for the same material. The integral parameters are as follows: thermal neutron cross-sections averaged over a Maxwellian neutron spectrum, with kT = 0.025298 eV; epithermal (resonance) integrals over a one I/E neutron flux distribution from 0.55 eV to 2 MeV; fission spectrum-averaged cross sections, using the Watt–Cranberg form for the prompt fission neutron spectrum from thermal neutron induced fission of U^{235}. (auth)

11337 (COO-2280-9) COMPUTATIONAL COMPLEXITY IN MULTIDIMENSIONAL NEUTRON TRANSPORT THEORY CALCULATIONS. Progress Report, September 1, 1973–August 31, 1974. Bareiss, E. H. (Northwestern Univ., Evanston, Ill. (USA)) 1974. Contract AT(11-1)-2280. 14p. Dep. NTIS $4.00.

Work on research to develop mathematically and computationally founded criteria for the design of highly efficient and reliable multidimensional neutron transport theory codes to solve a variety of neutron migration and radiation problems and to analyze existing and new methods for performance is described. Sections on strategy, historical remarks and reason for the proposed research, relationship to similar research efforts, and work accomplished are presented. Activities in the following areas are discussed: testing of numerical methods to approximate the transient part of the transport theory solution; tabular presentation of results; inversion of sparse matrices; behavior of the solutions of the diffusion and transport equation at corners and edges; and exact polar-coordinate solution of the diffusion equation. (RWR)

11338 (FEI-360) DEPENDENCE OF ALBEDO ON FAST NEUTRON POLARIZATION AT SCATTERING BY NUCLEI OF REFLECTOR. Van'kov, A. A.; Voropaev, A. I.; Tsibulya, A. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1972. 11p. (In Russian). INIS.

Attempts are made to estimate the effect of polarizing fast neutrons, occurring because of spin-orbital interaction in the process of elastic scattering, on the value of the albedo, and correspondingly, on the magnitude of reactivity of a fast reactor. For a reflector of liquid helium having a radius and thickness of 10 cm the effect of polarization on the albedo was $\Delta\beta = 0.0012$, while the effect on the reactivity was $\Delta k/k = 9 \times 10^{-4}$. For a reflector of niobium the magnitudes of the effects were an order of magnitude less. (SJR)

11339 (IAE-2237) GALERKIN METHOD FOR DIFFUSION EQUATIONS. Part 2. Two-Group Multiregion Problem in (r, z) Geometry. Lebedev, V. I.; Kurchenkova, G. I.; Tsapelkin, E. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1972. 12p. (In Russian). INIS.

The solution of diffusion problems by the Galerkin method in (r, z) geometry is considered. A multizone cylindrical reactor of radius R and height H is looked at, in which the neutron diffusion is described within the framework of two-group, diffusion theory. Design formulas are presented for the main integral characteristics of the reactor: the coefficient of volume power leveling out in the reactor, the coefficients for the average power along the radius and height of the reactor, the conversion coefficient, etc. (tr-auth)

11340 (IFA-DNBR-7-1973) DATA HANDLING PROGRAM SET FOR THE EVALUATED MICROSCOPIC NUCLEAR DATA STOCKED IN THE COMPUTERIZED LIBRARY "DANEM-I" FROM THE IAP. Mateescu, S.; Badescu-Singureanu, A.; Deciu, N. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 48p. (In Rumanian). Dep. NTIS (US Sales Only) $5.50.

The program set of the computerized evaluated microscopic nuclear data for reactors library DANEM-I from the I. A. P. which allows the automatic data stocking in standard formats (INDA, REZONANT), the stocked data correction (CORA-1/A), the selective retrieval of the data (REDA-1/A, REDA-2/B), and the output of the retrieved data in graphical form (GRIM), are described. (auth)

11341 (IFA-FR-119-1974) DTF-4: PROGRAM FOR THE SOLUTION OF THE ONE-DIMENSIONAL MULTIGROUP TRANSPORT EQUATION. Stanou, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 24p. (In Rumanian). Dep. NTIS (US Sales Only) $4.25.

DTF4 is a FORTRAN program for the solution of the one-dimensional multi-group transport equation (for planes, spheres, cylinders) by the discrete variable method (S_n method). The program described in this report is an adaptation for the IBM 370/135 of the programs DTF-IV and DTK. A sample problem with control characters is included. (RWR)

11342 (IKE-4-6-d) FIRST-FLIGHT COLLISION PROBABILITY METHOD USED FOR CALCULATING NEUTRON TRANSPORT IN TWO-DIMENSIONAL HETEROGENEOUS MEDIA. Gerstberger, E. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Aug 1972. 36p. (In German). INIS.

In the case of strongly heterogeneous media, the neutron flux and the neutron multiplication factor k(eff) have to be calculated by methods based on transport theory. The S_N method for instance requires approximations of higher order in this case, which in turn calls for extensive computing time, whereas the first-flight collision method requires less computing time while yielding equally accurate results. As the integrals of the first-flight collision probability of two-dimensional heterogeneous media cannot be integrated analytically, the attempt has been made in the present paper to represent the first-flight collision probability as the sum of "micro-first-flight collision probabilities" by proceeding from one macroregion to the other and by assuming the neutron flux and cross section to be constant, with the micro regions representing just a more precise subdivision of the macro regions. It was found that this method is particularly suitable for treating macro regions which are not directly adjacent to each other. (GE)

11343 (IKE-4-7-d) NUMERICAL SOLUTION OF THE ONE-DIMENSIONAL MULTIGROUP DIFFUSION EQUATION WITH REGARD TO THE IMPROVEMENT OF CONVERGENCE BY MEANS OF PHYSICAL BALANCE CONSIDERATIONS. Veihelmann, R. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Nov 1972. 63p. (In German). INIS.

Thesis.

Investigations are made into the possibility of using coarse mesh balancing methods according to the rebalancing and the Galerkin procedure for improving the convergence in neutron-physical up-

ward scattering. The two methods are derived and discussed. The coarse meshes are chosen so that they represent the reactor as a whole in one point and combine several energy groups into one macro group. The investigations are made with a problem with poor convergence as an example, namely the hot thermal compact reactor SNAP 8 DR. It is shown that both methods are suitable, the Galerkin procedure having a clear advantage over the other. This, however, may be due to the special characteristics of the problem in question. (16 figures, 3 tables) (GE)

11344 (IKE-4-9) HOMOGENIZATION AND CONDENSATION OF GROUP CROSS SECTIONS WITH THE RSYST-I CODE. Wohland, H.; Lutz, D.; Ruehle, R. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Oct 1972. 6p. (In German). INIS.

The homogenization and condensation of group cross sections can be performed with the RSYST-I code in combination with the modules MITHOM, HOMMIKRO and MITTEL. These procedures and their applications are described in this report. (tr-auth)

11345 (IKE-4-15) CALCULATION OF GROUP CONSTANTS IN THE RANGE OF RESOLVED RESONANCES. Gulden, W. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). 12 Jun 1973. 101p. (In German). INIS.

Thesis.

In order to calculate the group constants in the resonance range, the effective cross sections as well as the neutron flux densities as function of position and energy must be known. While the effective cross sections are generally known, it is necessary to make simplified assumptions on the computer to calculate the neutron flux densities, and these assumptions often give considerably different results depending on the degree of approximation. The region of resolved resonances is especially problematic, as the effective cross sections show a strong dependence on energy there. The influence of the various approximations for the neutron flux density in the range of the resolved resonances (energy, position and transport effects) on group constants and integral parameters such as K_{eff} has been investigated. The results of this investigation lead to the development of the RESPU programme, which by exactly solving the impact rate density in a two-zone arrangement gives good group constants and flux spectra in the resonance range with short computing time. (31 figures, 16 tables) (tr-auth)

11346 (IKE-6-61-1) THERM-123: A LIBRARY FOR THERMAL NEUTRON CROSS SECTIONS. Part 1. Moderators. Keinert, J. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Jan 1973. 168p. (In German). INIS.

In the present documentation, thermal neutron cross section values compiled in the "Institut fuer Kernenergetik" of the University of Stuttgart are presented. After a short review of the available program systems, the physical foundations of neutron scattering are discussed for moderators in this first part; and after a detailed documentation of the cross section codes used, the quality of the nuclear data is checked. (GE)

11347 (IKE-6-61-2) THERM-123: A LIBRARY FOR THERMAL NEUTRON CROSS SECTIONS. Part 2. Fissionable Materials. Keinert, J. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Jan 1973. 214p. (In German). INIS.

The second part of the neutron cross section documentation compiled by the "Institut fuer Kernenergetik" of the University of Stuttgart contains data for the fissionable materials uranium and plutonium, and comparisons are made between ENDF/B III, ENDF/B II and UKNDL cross sections. (GE)

11348 (INIS-mf-938) RAPID NEUTRON PULSE PROPAGATION IN LEAD. Paiano Sobrinho, S. (Sao Paulo Univ. (Brazil). Instituto de Fisica). 1971. 111p. (In Portuguese). INIS.

Thesis.

The formalism developed by Ohanian, Perez, Cockrell to study the fast neutron wave propagation, monoenergetic in a non-moderator and non-reproducer media was extended, including terms of third and fifth order in the development of the scattering cross section, $\Sigma(\mu)$, in Legendre polynomials. The resulting dispersion law, applied to some particular cases, suggests that the terms of order superior to the first one of $\Sigma_s(\mu)$ are important to frequencies over some megahertz. The neutron pulse propagation, with half-width of some nanoseconds and energy of 1.68 ± 0.03 MeV, in a lead prism with transversal dimensions of 20×25 cm, was experimentally studied. The utilized geometry avoided the detection of non-collided neutrons with lead and allowed an accurate subtraction of the background radiation. The pulses of the detector (NE-213 liquid scintillator) were stored in a multichannel analyzer with a 512×8 (time $\times$ energy) configuration. (auth)

11349 (RT/FI-(74)2) NUCLEAR DATA AND INTEGRAL MEASUREMENT CORRELATION FOR FAST REACTORS. Statistical Formulation and Analysis of Method: The Consistent Approach. Gandini, A.; Petilli, M.; Salvatores, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jan 1974. 16p. (CONF-731015-8). Dep. NTIS (US Sales Only) $4.00.

From IAEA conference on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

In recent years much has been written on the correlation between nuclear data and integral measurements obtained from fast critical assemblies. The statistical foundations of the currently used methods are analyzed. Emphasis has been given to those arguments which are concerned with systematic error search. A method of correlation between the basic nuclear parameters and the integral data, consistent with the group cross-section generation program adopted, is proposed. Its main advantage consists in its independence from the group schematization chosen and, consequently, in its flexibility with respect to practical cross-section collapsing requirements. (auth)

11350 (UCRL-50400(Vol. 2)(Rev. 1)) BIBLIOGRAPHY OF THE EXPERIMENTAL DATA OF NEUTRON-INDUCED INTERACTIONS. Perkins, S. T.; Cullen, D. E.; Haight, R. C.; Howerton, R. J.; MacGregor, M. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Mar 1974. Contract W-7405-eng-48. 638p. Dep. NTIS $13.60.

A tabulation of the bibliographic citations in the Experimental Cross Section Information Library (ECSIL) as of March 1, 1974 is presented. The tabulation is arranged in three different ways: alphabetically by author, alphabetically by publication, and numerically by reference number. (5 tables) (auth)

11351 (UCRL-75693) TESTING OF ENDF/B-IV-P EVALUATIONS WITH SDT-10 BENCHMARK PULSED SPHERES. Howerton, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 May 1974. 30p. Dep. NTIS $4.50.

As part of the Phase II data testing program for ENDF/B-IV-P data, the time spectra of the CSEWG Shielding Benchmarks Collection SDT-10 were calculated by using the TART Monte Carlo neutronics code in the standard mode. Calculated and experimental integrals of the time spectra are compared for three intervals: 0 to 161 ns, 161 to 401 ns, and 0 to 401 ns. Figures show the time spectra for H_2O, D_2O, ^6Li, ^7Li, ^9Be, ^{12}C, ^{14}N, ^{16}O, Mg, ^{27}Al, Ti, Fe, W, Pb, ^{235}U, ^{238}U, and ^{239}Pu. The report provides a general impression of the adequacy of the evaluations for systems sensitive to 14-MeV neutrons; however, quantitative assessment of the effects of any inadequacies is highly problem dependent. These calculations provide a means for assessing the adequacy of only those materials that were tested. Cursory inspection of the representations used for secondary energy spectra for incident neutron energies greater than about 6 MeV indicates that they would be in gross disagreement with pulsed sphere data if such data existed. (17 figures, 3 tables) (RWR)

11352 SPACE-AND TIME-DEPENDENT NEUTRON THERMALIZATION IN GRAPHITE BY REACTION-RATIO METHOD. Michikawa, T. (Electrotechnical Lab., Tokyo). J. Nucl. Sci. Technol. (Tokyo); 11: No. 2, 37-48(Feb 1974).

Space- and time-dependent neutron thermalization in a $230 \times 190 \times 190$ cm^3 graphite pile has been studied by considering the reaction ratios for Gd/^{10}B, Sm/^{10}B, Cd/^{10}B, Gd/Sm, Gd/Cd and Sm/Cd as spectral indicators. The reaction ratios were measured at r = 10, 30, 50 and 70 cm from the fast neutron source placed at the center of the pile. The measurements were repeated at 2.175 μsec intervals in the time range up to ~600 μsec after the fast neutron burst. Theoretical time-dependent reaction ratios were obtained from the calculated space- and time-dependent thermal neutron energy spectra by solving numerically the neutron diffusion equation, using scattering kernels based on various phonon models for graphite. From comparisons of the measured and calculated time-dependent reaction ratios, the adequacy of the various phonon models for graphite is discussed. Also, proof is given of space-dependence shown by the time-dependent thermal neutron spectra; and the relationship between the space-dependence of the time-dependent neutron spectra and that of the peaking times of the reaction ratios is made clear. (auth)

11353 MEASUREMENT OF COLD NEUTRON SPECTRUM WITH LIQUID MIRROR REFLECTION. Sugimoto, M.; Utsuro, M. (Kyoto Univ.). J. Nucl. Sci. Technol. (Tokyo); 10: No. 12, 726-730(Dec 1973).

By use of the wavelength dependency of the critical angle for the total reflection of neutrons, the possibility of determining the energy spectrum of cold neutrons by means of a liquid mirror is examined. A carbon tetrachloride mirror, combined with a pair of fine slits, is used for the measurement of the angular distribution of the reflection intensity of beryllium filtered neutrons. For determining the correction required to account for non-reflected neutrons detected by the counter, the direct beam component is measured by disturbing the liquid mirror surface with small ripples generated by an ultrasonic vibrator submerged in the

liquid, and the value obtained with this clouded mirror is subtracted from that determined with the clear undisturbed liquid mirror. The experimental results qualitatively show good agreement with those obtained with a helical-slot neutron velocity selector, and further reveal even better resolution than possible with the latter method, in the cold neutron energy region. (auth)

11354 GEOMETRIC PENUMBRA CALCULATIONS FOR A GAS TARGET NEUTRON SOURCE. Beach, J. L.; Kelsey, C. A. (Univ. of Wisconsin Hospitals, Madison). Radiology; 111: No. 1, 199-200(Apr 1974).

A computational approach is used to investigate the geometric effects of an extended gas target neutron source on the penumbra characteristics of a collimated 14 MeV neutron beam for radiotherapy. It was found that for a cylindrical gas target, 50 cm long, 2 cm in diameter, and operated at 10 torr of ^{3}T gas, the geometric penumbra is superior to that of a 2 cm diameter flat target at a comparable SSD. (auth)

11355 LINEAR MONOENERGETIC TRANSPORT WITH REFLECTING BOUNDARY CONDITIONS. Angelescu, N.; Marinescu, N.; Protopopescu, V. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 1, 17-26(1974).

The initial value problem is considered for monoenergetic neutron transport in homogeneous nonmultiplying medium with isotropic scattering and reflecting boundary conditions. The spectrum of the transport operator is completely determined both for plane and parallelepipedic geometries. (auth)

11356 DETERMINATION OF THE FAST NEUTRON SPECTRUM BY THE (n,p) ELASTIC SCATTERING METHOD. Diaz, J. E. Mexico City; Instituto Politecnico Nacional (1973). 90p. (In Spanish).

Thesis.

The fast neutron spectrum emitted by a Pu-Be source was measured by a method based on (n,p) spectrometry. The method consists in making a fast neutron beam collide with a film of a hydrogenous material and detection of the protons emitted at a fixed angle. The polyethylene film and the solid state detector used are placed in a vacuum chamber. The detector is positioned at 30° with respect to the direction of the incident neutron beam. The proton spectrum is stored in a multichannel. The data processing involves the transformation of the proton spectrum observed to the incident neutron spectrum. The neutron energy is related to that of the protons by use of kinematic equations of the collision. The elastic collision cross section of the neutrons with the hydrogen was obtained from the literature. By application of these relations to the spectrum observed, the incident neutron spectrum is obtained. (tr-auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstracts 11109, 11400, 11435, 11440, 11449, 11489, and 11613.

11357 (FRNC-TH-477) STUDY OF NUCLEAR FORCE CHARGE SYMMETRY (BARSHAY-TEMMER TEST) IN THE ^{4}He + ^{2}H → ^{3}He + ^{3}H REACTION AT 55 MeV (CENTER OF MASS SYSTEM). Hennino, T. (Paris-11 Univ., 91-Orsay (France)). 1973. 72p. (In French). Dep. NTIS (US Sales Only) $6.75.

Thesis.

The ^{4}He + ^{2}H → ^{3}He + ^{3}H reaction was studied at 55.3 MeV (center of mass system). This energy exceeds by a factor of two the highest energy at which this reaction had been previously studied. An attempt was made to achieve an accuracy of a few percent which enabled the independence of charge from nuclear forces to be examined. The quantitative agreement between the experimental asymmetry and that predicted from distorted wave calculations is good, this type of calculation providing a good description of the physical phenomenon. The reaction is essentially direct, the introduction of Coulomb effects enabling the asymmetry to be explained. It can be concluded that isospin is a good quantum number, and that the results confirm the independence of charge from nuclear forces. The theoretical curves can be better fitted to the experimental points for the asymmetry than for the cross sections. In the zero range, the $D_0(n)/D_0(p) = 1.03$ ratio (Bassel normalization) gives a very satisfactory result. The finite-range program (LOLA) gives a $D_0(n)/D_0(p)$ ratio (1.01) which is rather small. This smallness can be explained by the fact that the Coulomb interaction is not rendered sufficiently accurately by the hard-sphere model. (FR)

11358 (ORO-3948-6) PION INTERACTIONS AT MEDIUM ENERGIES. Progress Report, September 1, 1973-August 31, 1974. Allred, J. C.; Mayes, B. W. II. (Houston Univ., Tex. (USA)). 1974. Contract AT(40-1)-3948. 14p. Dep. NTIS $4.00.

During the past year the emphasis of this research has shifted to the P^3 pion channel at the Los Alamos Meson Physics Facility. In collaboration with Rice University this channel was successfully tuned and operating characteristics ascertained. Experimental work has begun on π^+ scattering from selected nuclei at forward angles to determine the forward π^- nuclear amplitude. Total cross sections for π^+ on these nuclei across the ($^3/_2$, $^3/_2$) resonance were completed. Deuterium break-up by 600 MeV protons was investigated under complete kinematic conditions. Continued development of multistrip scintillation detectors has resulted in the application of these instruments in on-going research. Two patents were granted Dr. Lap Yen Lee for these devices and a third is pending. A PDP-11 computer was acquired and is now being interfaced to a CAMAC data-way. One Ph. D. research thesis should be completed by the end of this summer. A list of publications is included. (auth)

11359 P-^{4}He ELASTIC SCATTERING AT 1.05 GeV. Baker, S. D.; Beurtey, R.; Bruge, G.; Chaumeaux, A.; Durand, J.; Faivre, J. C.; Fontaine, J. M.; Garreta, D.; Legrand, D.; Saudinos, J.; Thirion, J.; Bertini, R.; Brochard, F.; Hibou, F. (Department de Physique Nucleaire, Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). Phys. Rev. Lett.; 32: No. 15, 839-842 (15 Apr 1974).

The angular distribution of the elastic-scattering differential cross section of 1.05-GeV protons by ^{4}He has been measured from 3 to 47° lab. The main features of this measurement are that the first minimum is much less deep than previously measured and that, at the point where a second minimum is predicted by calculations, there is just a slight change of slope. (auth)

11360 MEASUREMENT OF THE COHERENT NEUTRON SCATTERING LENGTH OF ^{3}He BY REFLECTION FROM A QUARTZ-LIQUID-HELIUM INTERFACE. Kitchens, T.A.; Oversluizen, T.; Passell, L. (Brookhaven National Laboratory, Upton, New York 11973); Schermer, R.I. Phys. Rev. Lett. 32: No. 14, 791-794 (8 Apr 1974).

The real part of the bound-atom coherent neutron scattering length of ^{3}He has been measured by comparing the reflectivities of quartz-liquid-^{3}He and quartz-liquid-^{4}He interfaces and has been found to have the value $(6.1 \pm 0.6) \times 10^{-13}$ cm. (auth)

11361 COULOMB EFFECTS IN THE PROTON-INDUCED DEUTERON-BREAKUP REACTION. Takeutchi, F. (Kernforschungszentrum, Karlsruhe, Ger.); Sakamoto, Y. pp 374-350 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

Recently much attention has been paid to investigation for nucleon induced deuteron-breakup reaction. The remarkable difference has been observed between the cross sections for the ^{2}H(p,2p)n and ^{2}H(p,pn)p reactions at considerably low incident energies of protons. The cross sections are enhanced when the relative energy between a neutron and one of protons becomes small in the final state. In contrast, the enhancement of the cross section due to the final-state interaction is hindered by Coulomb effects when the relative energy between protons becomes small. The role of the Coulomb force in the cross sections for the reaction calculated with the final-state interaction (FSI) theory, in comparison with data at incident energies of protons around 46 MeV is reported. (auth)

11362 FUSION REACTIONS BETWEEN COMPLEX NUCLEI. Lefort, M.; Le Beyec, Y.; Peter, J. (Inst. de Physique Nucleaire, Orsay, France). Riv. Nuovo Cim.; 4: No. 1, 79-98(1974).

The discussion covers the height of the interaction barrier, limits due to the orbital angular momentum of the projectile in complete fusion, and the importance of the entrance channel for the complete fusion between two complex nuclei. (JFP)

11363 SEPARABLE APPROXIMATION METHOD OF THE AMADO-LOVELACE KERNEL. Oryu, S. (Science Univ. of Tokyo); Takahashi, Y.; Hiramoto, T.; Shioyama, S. pp 388-391 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

It is well known that the nonlocal two-body separable approximation plays an important role in the reduction of the Faddeev

formalism. The form of the separable reduction of three-body Lovelace potential in the four-body problem plays a similar role to two-body separable potential in the three-body problem. Previously a method to separate the kernel in three-nucleon problem was reported. In general, there are two separation methods of kernel. One of them is the expansion by eigenfunctions (Schmidt's method) and another is the expansion by using finite parameters (Bateman's method). In Bateman's method the analyticity of three-body kernel–particularly in case of three-body breakup process–is very complicated, and there are various singularities (poles and cuts) in three-body kernel. Furthermore, the range of integral can be taken from zero to infinity. In fact, Bateman's method was applied to the normal (nonsingular) kernel and to the case that the range of integral is finite. How to avoid these difficulties is reviewed, and also the result of separable form of Amado–Lovelace (A-L) kernel by Bateman's method is shown. As the simplest example, the break up process D(n,p)2n, at the incident energy 50 MeV is considered. (auth)

11364 BREAKUP CALCULATIONS IN NEUTRON–DEUTERON SCATTERING WITH LOCAL POTENTIALS. Kloet, W. M.; Tjon, J. A. (Rijksuniversiteit, Utrecht). pp 380-383 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

The differential cross sections for the reaction n + d → n + n + p at 14.4 MeV neutron laboratory energy are calculated for local S-wave two-body interactions. For the calculation a recently proposed method is used which consists of applying Padé technique to the multiple scattering series. The two-nucleon interaction used is restricted to S-wave potentials. The potentials are of Yukawa type and possess a soft repulsive core in both the singlet and triplet channel. In order to study the effect of repulsion in the two-body interactions the potential set which has a core only in the singlet channel is considered. (auth)

11365 ELASTIC NEUTRON–DEUTERON SCATTERING WITH LOCAL POTENTIALS. Kloet, W. M.; Tjon, J. A. (Rijksuniversiteit, Utrecht). pp 376-379 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

The results of a calculation of elastic n-d scattering for local potentials by applying Padé techniques to the multiple scattering series is presented. The potentials used for the two-nucleon interaction are restricted to only s waves. The calculations were performed in the energy range up to 50 MeV. It is shown for the case of local potentials that the rate of convergence of the approximants is sufficiently rapid. (auth)

11366 EXACT-UNITARY MODEL CALCULATIONS OF THREE-PARTICLE SCATTERING. Cahill, R. T. (Australian National Univ., Canberra); McCarthy, I. E.; Tandy, P. C. pp 372-375 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

Calculations based upon the exact-unitary model of Cahill (1971) for the n-d system at 14.4 MeV incident neutron energy are given. The model was found to be quite successful in reproducing elastic differential cross sections. The calculations were extended to unitary model break-up spectra. The initial results indicate that the situation is quite different from the elastic case. In this initial application only the gross features of the break-up spectra were reproduced. A brief account is given of the calculations and some typical results indicated for elastic scattering and break-up. The calculations to S-wave nucleon-nucleon interactions are confined, and the two-nucleon scattering information from the Yamaguchi triplet- and singlet- spin separable interactions was taken. The results are compared with exact solutions of the Faddeev equations for these particular interactions. (auth)

11367 VARIATIONAL APPROACH TO BREAKUP CALCULATIONS IN THE AMADO MODEL. Brady, T. J.; Sloan, I. H. (Univ. of Maryland, College Park). pp 364-367 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

In Amado's model of neutron-deuteron scattering the scattering equation reduces after partial-wave analysis to a one-dimensional integral equation. A recently proposed variational approach to equations of the Lippman-Schwinger type is tested by using the method to solve this equation for a case in which the exact solution is already known. Specifically considered is the 14.4 MeV S-wave doublet case (so that there are two coupled integral equations). (auth)

11368 SOME METHODS OF SOLVING THE THREE BODY PROBLEM AT POSITIVE ENERGY. Belyaev, V. B.; Efimov, V. N.; Schulz, H.; Tkachenko, E. G. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 361-363 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

It is known that the kernels of the Faddeev equations at the positive total energy of the three body system have moving logarithmic singularities of the kinematical origin on the real axis. This complicates significantly the solution of the problem of the nd scattering above the threshold of the deuteron break up. Nevertheless, recently in a number of works the approximate methods of solution of such equations have been proposed. From the methodological point of view it seems worthwhile to compare the different methods of solution using for this purpose a model equation which has sufficiently simple structure and contains at the same time all the singularities of the realistic case. The equation of Skornyakov-Ter-Martiro-syan (STM) for the quartet nd scattering in the S state is just of this type. Two different ways of solving the STM equation are presented. (auth)

11369 NEUTRON–DEUTERON ELASTIC SCATTERING ABOVE THE BREAKUP THRESHOLD. McDonald, F. A. (Southern Methodist Univ., Dallas); Nuttal, J. pp 384-387 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

The three-nucleon scattering problem, with local two-nucleon potentials, is studied using the method of complex coordinates to calculate scattering amplitudes. The method is similar in practice to use of a Kohn variational principle, but avoids the need for including complicated asymptotic terms representing three free particles, the latter being required by a Kohn principle in the energy region above the deuteron-breakup threshold. This method provides an alternative to those which first calculate the two-nucleon t-matrix, often in a separable approximation, and then techniques based on the Faddeev equations are applied. (auth)

11370 BINDING ENERGIES OF TRITON AND ALPHA-PARTICLE WITH MESON-THEORETICAL POTENTIALS. Akaishi, Y. (Hokkaido Univ., Sapporo); Sakai, M.; Tanaka, H.; Hiura, J. pp 353-356 of Few Particle Problems in the Nuclear Interaction. Slaus, I. (ed.). Amsterdam; North-Holland Publishing Co. (1972).

From proceedings of the international conference on few particle problems in the nuclear interaction; Los Angeles, CA (28 Aug 1972).

A new variational method is proposed. This method is applicable to both three- and four-nucleon systems. This new variational method unifies the variational approach and the reaction-matrix approach. The trial wave function is constructed with the two-body scattering correlation through multiple scattering process started from an appropriate initial wave function. Calculations are presented for the triton and the alpha-particle. The Hamada-Johnston and Tamagakis OPEH potentials are used as realistic potentials. (auth)

11371 POLARIZATION TRANSFER IN ^{4}He(d,d)^{4}He ELASTIC SCATTERING. Ohlsen, G. G.; Salzman, G. C.; Mitchell, C. K.; Simon, W. G.; Grueebler, W. (Los Alamos Scientific Lab., NM). Phys. Rev., C; 8: No. 5, 1639-1648(Nov 1973).

Measurements of the 4 analyzing tensors and of up to 14 polarization-transfer coefficients, at each energy and angle studied, are reported for ^{4}He(d,d)^{4}He elastic scattering. This number of observables greatly overdetermines the scattering matrix, and many consistency checks are therefore available. These data represent the first measurements of polarization-transfer phenomena in which both the incident and outgoing polarized particles have spin 1. Bombarding energies were in the range 4.8 to 9.0 MeV. (4 figures, 6 tables) (auth)

11372 POLARIZATION TRANSFER IN THE ^{3}He(d,p)^{4}He REACTION. Hardekopf, R. A.; Armstrong, D. D.; Grueebler, W.; Keaton, P. W. Jr.; Meyer-Berkhout, U. (Los Alamos Scientific Lab., NM). Phys. Rev., C; 8: No. 5, 1629-1638(Nov 1973).

Measurements were made of seven polarization transfer coefficients for the $^3He(d,p)^4He$ reaction. The experiment used a polarized-deuteron beam from the Los Alamos Scientific Laboratory Lamb-shift polarized-ion source, a liquid-nitrogen-cooled ^3He gas target, a magnetic quadrupole triplet for focusing the reaction protons, and a helium-filled polarimeter for simultaneously measuring the proton polarization along both transverse axes. Measurements were made of the polarization transfer coefficients $K_y^{y'}$ and $K_{yy}^{s'}$ at $\theta = 0°$ for 4- to 14-MeV deuterons. A comparison of the $K_y^{y'}$ results with the values reported for the $^3H(d,n)^4He$ reaction over the same energy range shows good agreement, as would be expected for the two charge-symmetric reactions. In addition, the proton polarization $P^{y'}$; the vector transfer coefficients $K_y^{y'}$, $K_x^{s'}$, and $K_z^{s'}$; and the tensor transfer coefficients $K_{xx}^{y'}$, $K_{yy}^{y'}$, $K_{zz}^{y'}$, and $K_{xz}^{y'}$ were measured at 8.0 MeV for laboratory angles of 15, 30, 45, and 60°. Calculated values for these observables from an R-matrix parametrization of the five-nucleon system are in good agreement with the data. (6 figures, 4 tables) (auth)

11373 EXCHANGE EFFECTS IN RADIATIVE n–p CAPTURE. Thakur, J.; Foldy, L. L. (Case Western Reserve Univ., Cleveland). Phys. Rev., C; 8: No. 5, 1957-1958(Nov 1973).

The contribution of the one-pion-exchange interaction current to the transition amplitude for radiative n–p capture at thermal energies is evaluated by using the Chew–Low static model for the amplitude for photoproduction of pions off nucleons. A correct treatment of the pion-rescattering term in that amplitude gives essential agreement with the static-quark-model calculation of Riska and Brown, which considers only nucleon excitation to the $\Delta(1236)$ state. (auth)

11374 PERTURBATIVE CALCULATION OF SPIN OBSERVABLES IN NUCLEON–DEUTERON ELASTIC SCATTERING. III. Comparison with an Exact Calculation. Pieper, S. C. (Argonne National Lab., IL). Phys. Rev., C; 8: No. 5, 1702-1705(Nov 1973).

A previously presented perturbative calculation of elastic nucleon–deuteron scattering is compared with the exact calculation of Doleschall. It is found that the nucleon polarization in N–d scattering is not accurately predicted by the perturbation theory but that the vector and tensor deuteron polarizations are in satisfactory agreement with the exact calculation. It is suggested that considerably more complicated potentials than those now in use will have to be employed to predict the nucleon polarization data at energies above 14 MeV. Some calculations of recently measured spin-transfer coefficients are presented and compared with the available data. (8 figures) (auth)

11375 DISTORTION EFFECTS IN d + α SYSTEM. Thompson, D. R.; Tang, Y. C. (Univ. of Minnesota, Minneapolis). Phys. Rev., C; 8: No. 5, 1649-1664(Nov 1973).

The deuteron specific distortion effect in the d + α problem is considered with a microscopic procedure. This procedure consists in the addition of square-integrable or distortion functions into the usual no-distortion resonating-group wave function. The result shows that, with the consideration of this effect, a nucleon–nucleon potential which fits the low-energy two-nucleon scattering data and which yields a satisfactory agreement with the empirical $\alpha + \alpha$ phase shifts can be used to describe quite well the d + α experimental data. Also, it is shown that the specific distortion effect has an odd–even character; it has significant effects in even-l states, but not in odd-l states. Resonance structures are found in the partial-wave scattering amplitudes. These structures arise as a consequence of the coupling of the compound-nucleus states with the elastic scattering channel. (7 figures, 6 tables) (auth)

11376 SEQUENTIAL REACTIONS INDUCED BY ALPHA PARTICLES ON ^3He. Halbert, M. L. (Oak Ridge National Lab., TN); van der Woude, A.; O'Fallon, N. M. Phys. Rev., C; 8: No. 5, 1621-1628(Nov 1973).

A prominent peak has been observed in the forward-angle spectra of α particles for ^3He bombarded by 63.7-, 71.7-, or 81.4-MeV α particles. The energy of the peak was consistent with a sequential decay process involving the 2.18-MeV state of ^6Li. At 71.7 MeV, proton spectra measured at backward angles showed that the cross sections for formation of $^6Li^*$ (2.18 MeV) agreed with the intensity of the prominent α peak. The peak shape and position implied that the α particles were preferentially emitted forward with respect to the original $^6Li^*$ direction. Two other peaks were observed in some of the α spectra, one of them possibly the result of a sequential decay involving ^6Li. (6 figures, 1 table) (auth)

11377 MESON-EXCHANGE CURRENTS AND ^3H, ^3He MAGNETIC MOMENTS. Kim, Y. E. (Purdue Univ., Lafayette, IN); Harper, E. P.; Tubis, A.; Rho, M. J. Phys. Soc. Jap., Suppl.; 34: 498-502(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

It is shown that the discrepancy between the experimental ^3H, ^3He isovector magnetic moment and the single-particle value is very nearly accounted for by two-nucleon one-pion-exchange contributions. About two-thirds of the discrepancy is given by trinucleon S–D matrix elements. (1 figure, 2 tables) (auth)

11378 ISOSCALAR PART OF THE EXCHANGE MAGNETIC MOMENT. Fujita, T. (Tokyo Univ.); Horikawa, Y.; Yazaki, K. J. Phys. Soc. Jap., Suppl.; 34: 503-508(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The isoscalar part of the exchange magnetic moment is calculated by the ρ-exchange model for the long-range part and the OBE model for the short-range part. The application to the deuteron and the trinucleon system shows that the latter explains the main parts of the observed deviations. (4 figures, 4 tables) (auth)

Nuclear Properties and Reactions, $6 \leq A \leq 19$

Refer also to abstracts 10474, 11140, 11422, 11435, 11440–11442, 11447, 11508, 11519, 11615, 11616, and 11697.

11379 (ANL-8088) MEASUREMENT OF THE TOTAL CROSS SECTIONS FOR THE $^7Li(d,p)^8Li$, $^6Li(^3He,n)^8B$, $^6Li(d,\alpha)^4He$, $^6Li(d,p)^7Li$, AND $^6Li(d,n)^7Be$ REACTIONS. McClenahan, C. R. (Argonne National Lab., Ill. (USA)). Mar 1974. Contract W-31-109-eng-38. 108p. Dep. NTIS $5.45.

Thesis. Submitted to Northwestern Univ.

The total cross sections were measured for five reactions involving charged particles bombarding lithium. These reactions are: $^7Li(d,p)^8Li$, $^6Li(^3He,n)^8B$, $^7Li(d,\alpha)^4He$, $^6Li(d,p)^7Li$, and $^6Li(d,n)^7Be$; all have potential applications in controlled thermonuclear reactions. The uncertainty in the cross sections is less than 15%, which is sufficient accuracy for reactor design. Where possible, detailed comparisons to previous work are given. The $^7Li(d,p)^8Li$ reaction cross section was measured from 280 keV to 3.8 MeV. The cross section rises rapidly from 71 nb at 280 keV to about 138 mb at 750 keV. The cross section then dips to about 110 mb at 1.0 MeV, after which it rises to its maximum of about 220 mb at 3.3 MeV. The cross section then falls to about 156 mb at 3.8 MeV. Cross sections for the $^6Li(^3He,n)^8B$ reaction were measured between threshold (2.966 MeV) and 3.8 MeV, and between 5.4 MeV and 7.5 MeV. Below 3.8 MeV, the cross section is proportional to the outgoing neutron velocity, rising to 7.0 mb at 3.8 MeV. At 5.4 MeV, the cross section is 19.9 mb, and it decreases monotonically to 11.9 mb at 7.5 MeV. The $^6Li(d,\alpha)^4He$ and $^6Li(d,p)^7Li$ reaction cross sections were measured between 0.5 and 3.45 MeV. There is a peak of about 28 mb at 0.75 MeV for the (d,α) reaction, a minimum of about 15 mb at 2.9 MeV, and then the cross section rises to about 26 mb at 3.45 MeV. The (d,p_0) cross section rises to a maximum of about 63 mb at 0.95 MeV above which it falls smoothly to about 39 mb at 3.45 MeV. For the (d,p_1) reaction, the cross section rises to about 37 mb at 1.45 MeV and remains nearly constant at about 37 mb up to 3.45 MeV. Cross sections for the $^6Li(d,n_1)^7Be^*$ reaction were measured from 0.45 to 2.95 MeV. The $^6Li(d,n_1)^7Be^*$ cross section rises to about 38 mb at 1.2 MeV and then remains nearly constant up to 2.95 MeV. The (d,n_0) reaction cross section was inferred from the (d,p) and (d,n_1) reaction cross sections and from previously experimentally verified charge symmetry. The (d,n_0) reaction cross section was found to increase to about 69 mb at 0.95 MeV and then to fall smoothly to about 39 mb at 2.95 MeV. (auth)

11380 (COO-3235-40) DISPERSION CORRECTIONS TO ELASTIC ELECTRON SCATTERING BY ^{12}C AND ^{16}O. II. On the Use of the Closure Approximation. Friar, J. L.; Rosen, M. (Brown Univ., Providence, R. I. (USA). Dept. of Physics; Naval Research Lab., Washington, D. C. (USA)). 1973. Contract AT(11-1)-3235. 64p. Dep. NTIS $6.25.

Within the framework of the closure approximation, dispersion corrections to elastic electron scattering from ^{12}C and ^{16}O were calculated by using the harmonic oscillator shell model and keeping only the Coulomb contributions to the dispersive part of the second-Born amplitude. Center-of-mass effects and recoil were taken into account. By means of an expansion scheme, the first-order corrections to the closure approximation were also calculated; and under certain conditions, it is believed that the corrected expansion is a valid one. It is found that the effective excitation energy, defined by the expansion, is approximately

one oscillator spacing. The relation between this calculation and a previous one by deForest is discussed. (10 figures) (auth)

11381 (EFI-YF-12(72)) INVESTIGATION OF (γ,p) REACTION AT MAXIMUM ENERGY OF BREMSSTRAHLUNG PHOTONS IN THE RANGE OF 100 TO 250 MeV. Bochek, G. L.; Egiyan, K. Sh.; Kulibaba, V. I. (Erevanskij Fizicheskij Inst. (USSR)). 1972. 44p. (In Russian). INIS.

The photoproduction of fast protons is investigated at maximum energy of bremsstrahlung photons of 100 to 250 MeV. A study of the excitation function of the (γ,p) reaction on ^{12}C under various kinematic conditions, and a study of the dependence of the reaction cross section as a function of the kinetic energy and emission angle of the protons on ^{12}C, ^{63}Cu and ^{208}Pb nuclei show that in the region of maximum energy $E_\gamma < 200$ MeV the experimental data can be explained by a quasideuteron mechanism of photoproton formation. For $E_\gamma > 200$ MeV it is necessary to take into account the contribution of a photomeson mechanism. (SJR)

11382 (JINR-P4-7741) CHARGE FORM FACTORS IN NUCLEI IN THE ALPHA-CLUSTER PROJECTION MODEL. Inopin, E. V.; Kinchakov, V. S.; Luk'yanov, V. K.; Pol, Yu. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 34p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

Transition densities are calculated for a series of states of alpha-clusterized nuclei ^{12}C, ^{16}O, ^{24}Mg, ^{28}Si, ^{32}S and ^{40}Ca. The corresponding charge form factors of the electron scattering are compared with experiment. (auth)

11383 (MATSCIENCE-78, pp 4-36) PHOTOPIONS FROM NUCLEI. Srinivasa Rao, K. (Inst. of Mathematical Sciences, Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

Configuration mixing particle-hole models, besides the simple independent particle model, were used in a quantitative analysis of photoproduction of positive pions from ^{16}O. The effect of two-particle-two-hole correlations in the ground state wave function of ^{16}O, as well as the effect of the Saxon-Woods basis, instead of the harmonic oscillator basis, on the cross sections was studied. The theoretical cross sections are in good agreement with experimental data. In the case of ^{11}B, the surface production mechanism accounts for the experimental charged pion photoproduction cross sections when the simple independent particle model is used for the description of nuclear states. A comparison of the results from our theory is made with those obtained by others using the "elementary" particle treatment for nuclei. (auth)

11384 (MATSCIENCE-78, pp 67-83) STUDY OF PION-SCATTERING BY ^{12}C IN THE IMPULSE APPROXIMATION. Mahalanabis, J. (Saha Inst. of Nuclear Physics, Calcutta); Banerjee, P. K. [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The scattering of pion is studied using a very simple model for the nucleus and the impulse approximation. The spirit of the impulse model is that one sums the elementary interactions coherently over all the nucleons in the nuclei. Also the plane wave is used for the incident pions. As input the elementary pion nucleon phase shifts are used and the nuclear size as obtained from the elastic electron scattering data. (JFP)

11385 (MATSCIENCE-78, pp 84-97) PHOTOPRODUCTION OF NEGATIVE PIONS FROM CARBON-12. Srinivasa Rao, K. (Inst. of Mathematical Sciences, Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The cross sections for negative pion photoproduction from ^{12}C are calculated, taking into account the two-particle-two-hole correlations in the ground state wave function of ^{12}C, in the Saxon-Woods basis, and the results are compared with those obtained in the harmonic oscillator basis. (auth)

11386 (MATSCIENCE-78, pp 168-184) FOUR BODY CORRELATION AND QUARTET STATES IN NUCLEI. Satpathy, L. (Berhampur Univ., Orissa, India). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

With special reference to "quartet," the nature of different types of four body correlations in nuclei is discussed. A phenomenological quartet shell model is described to predict the intra-shell quartet states which are supposed to be due to a different mode of excitation in contrast to the inter-shell quartet excitation of Arima, Gillet and Ginocchio. A microscopic calculation in the multiconfiguration Hartree-Fock model provides support to this hypothesis. (auth)

11387 (MATSCIENCE-78, pp 195-200) DETERMINATION OF INDUCED TENSOR COUPLING CONSTANT IN MUON CAPTURE. Parthasarathy, R.; Devanathan, V. (Univ. of Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The plausible value of the induced tensor coupling constant in muon capture is determined from the analysis of the experimental capture rates in ^{12}C and ^{16}O. This value can be used in the estimation of other observables such as recoil nuclear polarization in muon capture. (auth)

11388 (MATSCIENCE-78, pp 210-238) CONSISTENT STUDY OF THE NUCLEUS. Jain, B. K. (Bhabha Atomic Research Centre, Bombay). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

It is shown that by analyzing the various knock-out reactions, electron scattering, and pion absorption together, it should be possible to determine a consistent and complete single particle description of the nucleus. This is illustrated by discussing the (p,2p), (e,e'p), (e,e), and (π^-,NN) reactions on ^6Li, ^{12}C, and ^{40}Ca. Distorted momentum, angular correlation, one-neutron energy spectrum, and recoil momentum distributions are found. (JFP)

11389 (ORNL-TM-4589, pp 11-12) NEUTRON TOTAL CROSS SECTION OF ^6Li FROM 100 eV TO 1 MeV. Harvey, J. A. Jun 1974.

In report to the U. S. Nuclear Data Committee.

11390 REACTION $^{19}F(^3He, d)^{20}Ne$ AT 20 TO 23 MeV. Obst, A. W.; Kemper, K. W. (Florida State Univ., Tallahassee). Phys. Rev., C; 8: No. 5, 1682-1691 (Nov 1973).

Fourteen deuteron groups populating levels to 10.26 MeV excitation in ^{20}Ne were measured with the ^{19}F (^3He, d)^{20}Ne reaction Excitation functions measured at $\theta_{Lab} = 25$ and 45° from 20.0 to 21.2 MeV reveal little structure, and therefore probably little compound-nucleus contribution to the observed cross sections for the deuteron groups. In particular, the 2⁻ level at 4.97 MeV excitation, strongly populated at $E_{^3He} = 10$ MeV, is weakly populated in the present energy range. The "j-forbidden" 4⁺ level at 4.25 MeV excitation, on the other hand, is strongly populated in the present energy range. A collective-model coupled-channel Born- approximation analysis of angular distributions measured at $E_{^3He} = 21$ and 23 MeV is better able to explain the data than distorted-wave Born-approximation analysis for the positive-parity states are poorly described by both theories. (auth)

11391 CALCULATION OF NUCLEAR REACTIONS IN ^{16}O IN THE RANDOM-PHASE APPROXIMATION. Ho-Kim, Q. (Universite Laval, Quebec). Phys. Rev., C; 8: No. 5, 1574-1584 (Nov 1973).

A practical formalism of low-energy nuclear reactions is presented in which the ground-state correlations are treated in the random-phase approximation. The building blocks of the method are the matrix elements of two weakly energy-dependent effective interactions describing particle-hole pair scattering and pair creation or annihilation in a correlated system. The corresponding transition operators, which give complete information on any nuclear reaction, are then introduced. The method is applied to a study of nucleon scattering and photonuclear and muonuclear reactions proceeding through the 1-states of ^{16}O. The single-particle basis states are generated by a local, real Woods-Saxon potential, while the residual interaction has a zero range. In the relatively high excitation energy being studied, the correlations retained in the random-phase approximation affect nucleon scattering very little but reduce transition rates in photonuclear reactions and muon caputre by about 8%. (8 figures 1 table) (auth)

11392 SHELL-MODEL CALCULATIONS FOR A = 6 TO 14 NUCLEI WITH A REALISTIC INTERACTION. Hauge, P. S.; Maripuu, S. (Michigan State Univ., East Lansing). Phys. Rev., C; 8: No. 5, 1609-1620 (Nov 1973).

Shell-model calculations were performed on the normal-parity states of Op-shell nuclei with A = 6 to 14. The Hamiltonian was diagonalized in the full Op basis, and the effective two-body interaction was computed from the Sussex relative harmonic-oscillator matrix elements. The second-order corrections to the two-body matrix elements were calculated for all intermediate states up to $2\hbar\omega$ excitation energy. The harmonic-oscillator size parameter was taken to be constant at 1.7 fm for all nuclei, and the $p_{\frac{1}{2}} - p_{\frac{3}{2}}$ single-particle energy splitting was determined for each mass number by a least-squares rms fitting to the experimental spectrum. Static and dynamic properties of the energy levels were calculated and found to be usually in good agreement with experiment. (6 figures, 6 tables) (auth)

11393 POSSIBLE FORM FOR THE ^{6}Li–^{6}Li OPTICAL POTENTIAL. Perez, S. M. (Univ. of Cape Town). Phys. Rev., C; 8: No. 5, 1606-1608(Nov 1973).

It is shown that the potential obtained by folding a nucleon–nucleon interaction into the ion densities gives a good description of the real part of the optical potential for ^{6}Li–^{6}Li scattering between 9 and 16 MeV center of mass. Some evidence is found for an additional repulsive term at lower energies. (2 figures, 2 tables) (auth)

11394 SPECTROSCOPY OF ^{10}B LEVELS FROM THE ^{9}Be(d,n)^{10}B REACTION. Park, Y. S.; Niiler, A.; Lindgren, R. A. (Army Ballistic Research Lab., Aberdeen Proving Ground, MD). Phys. Rev., C; 8: No. 5, 1557-1573(Nov 1973).

Levels in ^{10}B were studied with the ^{9}Be(d,n)^{10}B reaction at 7, 12, 15, and 16 MeV incident energy. Neutron angular distributions for transitions to levels below 7 MeV excitation were measured with a time-of-flight spectrometer, and they were compared with distorted-wave Born-approximation (DWBA) calculations. Emphasis was placed on examining the previously reported discrepancy in the T = 1 relative spectroscopic factor (S_{rel}) between (d,n) and (^{3}He,d) reactions. It was found that the discrepancy still exists, though to a lesser degree, and that the S_{rel} values from (d,n) appear to be energy dependent. Sensitivity of calculations to the choices of deuteron potential sets as well as of other DWBA parameters was carefully examined in order to extract reliable spectroscopic factors. It was found that noncut-off DWBA calculations failed to reproduce the detailed structure of the measured angular distributions beyond stripping peaks when "measured" deuteron potential parameters were used in the calculations. Also, excitation functions were measured at $\theta_{lab} = 15°$ from 14 to 16 MeV in order to check the reaction mechanism for this energy range. The extracted spectroscopic factors compare poorly with the theoretical values of Cohen and Kurath as well as those of Varma and Goldhammer. (13 figures, 5 tables) (auth)

11395 STABILITY AND PERSISTENCY OF ALPHA-CLUSTER STRUCTURE. Abe, Y. (Hokkaido Univ., Sapporo); Takigawa, N. Progr. Theor. Phys. (Kyoto), Suppl.; No. 52, 228-281(Aug 1973).

Discussions are given to clarify the mechanism and the extent of deviation from the alpha-cluster structure in the ground band of ^{12}C, and to investigate the intermediate nature of clustering, or the persistency of the alpha-cluster structure under the influence of single particle spin-orbit force. The outline of molecular-orbital model is reviewed, with which it is possible to estimate the polarization of constituent alpha-clusters in nuclear intrinsic states and to investigate its effect on the stability of cluster configurations. The stability of the dumbbell geometry and the triangular one of the alpha clusters is discussed. A hybrid model is outlined, which enables one to take into account the important effect of the single-particle spin-orbit force on the stability of clusterization and on the effective moment of inertia. The admixture of the components with lower symmetry into the wave functions of the dumbbell geometry and the triangular one of the alpha-clusters is discussed in detail for the nuclei ^{8}Be and ^{12}C. The structure of ^{9}Be nucleus is discussed by making use of a microscopic model. The persistency of clusterization in odd system is examined variationally paying attention to the coupling between a valence nucleon and a clusterized core. Discussion is given for the overall exchange effect among a neutron and two α-particles. Conclusions on the alpha-cluster structure of the nuclei ^{8}Be and ^{12}C are presented. (auth)

11396 MANY-BODY THEORETICAL DESCRIPTION OF ALPHA-LIKE FOUR-BODY CORRELATIONS. Kamimura, M. (Kyushu Univ., Fukuoka); Takada, K.; Marumori, T. Progr. Theor. Phys. (Kyoto), Suppl.; No. 52, 282-338(Aug 1973).

The purpose of the study is to establish unified microscopic theory in which the shell-model aspect and the alpha cluster aspect in light nuclei are combined. The structure of strong four-body correlation is investigated within this framework. Although there exists the very strong alpha-like four-body correlation which is against the stability of Hartree–Fock field, the field is still stable in the neighborhood of ground states to realize shell structure. The detailed properties of the four-body correlation are investigated, which is decomposed into two parts, spatial correlation and ground-state correlation. If the strength of the effective two-body interaction responsible for the four-body correlation increases and passes through a critical value, ground-state wave function changes suddenly, and "phase transition" from shell-model "phase" to alpha cluster "phase" occurs. The various investigations developed show that the present picture is considerably reasonable. However, the work was just started, and there are many open problems being left. The relation between the alpha-like spatial correlation and the ground-state correlation is discussed, but not enough. It will be important to investigate the relation between the two types of wave functions, such as the ground-state wave functions after the "phase transition" and the Block–Brink type of model wave function. Qualitative discussion is made on the first excited 0^{+} states in ^{16}O and ^{40}Ca, which has been the motive of the present picture, but quantitative analysis has not yet been done. The present theory has been developed for the ground and low excited states. The theory should be generalized for higher excited states. (Kato, T.)

11397 ELASTIC SCATTERING OF ^{6}Li ON ^{6}Li IN THE ENERGY RANGE E_{cm} = 2 TO 10 MeV. Gruber, G.; Dormehl, I. C.; Meier-Ewert, K.; Bethge, K. (Univ., Heidelberg). Z. Phys.; 265: No. 4, 411-420(Nov 1973).

In a coincidence experiment, two excitation functions $\theta_{cm} = 60°$ and 90° and four angular distributions of the differential cross section for the elastic scattering of ^{6}Li on ^{6}Li were measured. The energy range for the excitation functions was from 2 to 10 MeV (cm), the angular distributions were taken at cm-energies of 4, 5, 6, 7.25 MeV. Optical model calculations were performed. It is shown that the outer portion of the potentials is most important for reproducing the experimental data. (GE)

11398 MAGNETIC MOMENT OF β-EMITTER ^{8}B. Minamisono, T.; Nojiri, Y.; Mizobuchi, A.; Sugimoto, K. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap., Suppl.; 34: 156-157(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11399 VALUE FOR THE RATIO OF Q(^{12}B) TO Q(^{13}B) DEDUCED FROM QUADRUPOLE COUPLINGS IN A Mg SINGLE CRYSTAL. Haskell, R. C.; Madansky, L. (Johns Hopkins Univ., Baltimore). J. Phys. Soc. Jap., Suppl.; 34: 167-169(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11400 NUCLEAR MOMENTS OF CONJUGATE NUCLEI. Sugimoto, K. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap., Suppl.; 34: 197-204(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Magnetic moments of conjugate nuclei are analyzed together with the Gamow–Teller moments in the framework of a one-body operator and charge symmetry. The information on the isoscalar parts is sensitive to the small correction due to the relativistic effect. Anomalies of the effective factors for nucleons in nuclei are also discussed. (3 figures, 2 tables) (auth)

11401 NMR OF IMPLANTED NUCLEI FOLLOWING NUCLEAR REACTION. Minamisono, T. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jpa., Suppl.; 34: 324-330(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Determinations of the magnetic moments of ^{8}B(I = 2, T = 0.77s) and ^{41}Sc(I = $^{7}/_{2}$, $T_{\frac{1}{2}}$ = 0.59s) and the assignment of the sign of eqQ of ^{12}B implanted in Ta are presented. The method, which uses NMR and detection by the asymmetric β decay, was improved by use of polarization reversal by adiabatic passage and use of a cooled recoil stopper at liquid-helium temperature. Preliminary results of measurements on the energy dependence in the asymmetric β decay of ^{12}B and ^{12}N are also presented. (8 figures) (auth)

11402 SEARCH FOR WEAK-ELECTRIC MOMENT IN THE BETA DISINTEGRATION OF THE A = 12 ISOBARS. Steels, M.; Grenacs, L.; Lehmann, J.; Palffy, L.; Possoz, A. (Louvain Univ., Belgium). J. Phys. Soc. Jap., Suppl.; 34: 350-353(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

By comparison of counting rates of beta particles from polarized and inversely polarized ^{12}B nuclei, the decay asymmetry was measured as a function of the electron kinetic energy. The preliminary result for the slope of the decay asymmetry, normalized to complete vector polarization, is $\Delta A_1 = -1.7 \pm 2.3 \times 10^{-3}$ MeV^{-1}. The theoretical prediction based on the assumption that the whole lifetime asymmetry in the decay of ^{12}B–^{12}N mirror nuclei is due to the divergenceless second-class induced tensor current is $+3.5 \times 10^{-3}$ MeV^{-1}. By operating the spin inversion of ^{12}B by transverse pulse technique the magnetic moment of ^{12}B was measured: $|\mu(^{12}B)| = (1.09 \pm 0.05)\mu_N$. (2 figures, 1 table) (auth)

11403 SOME NEW DEVELOPMENTS IN DIRECT REACTIONS INDUCED BY HEAVY IONS. von Oertzen, W. (Max-Planck-Institute fuer Kernphysik, Heidelberg). pp 267-294 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

After a brief introduction, progress in experimental techniques is outlined. Some specific aspects of heavy-ion reactions are then

detailed which show their unique possibilities; these include nuclear and Coulomb effects in elastic and inelastic scattering, elastic transfer, and multinucleon transfer. Finally, some new concepts developed for the interpretation of transfer reactions are set forth. Semiclassical models and window effects are discussed in some detail; the cross section is found to depend on three factors which are easily calculated. Discussions of finite-range effects and high-energy reactions conclude the paper. (20 figures) (RWR)

11404 MULTINUCLEON REMOVAL IN 220-MeV π^- REACTIONS WITH A ≤ 51 NUCLEI. Lind, V.G. (Utah State University, Logan, Utah 84322); Plendl, H.S.; Funsten, H.O.; Kossler, W.J.; Lieb, B.J.; Lankford, W.F.; Buffa, A.J. Phys. Rev. Lett. 32: No. 9, 479-482 (4 Mar 1974).

We have detected and identified prompt γ rays from residual nuclei formed in 220-MeV π^- reactions with C, F, O, Mg, Al, Si, S, Ca, and V. Cross sections for 2n + 2p removal from the even-A, even-Z = N targets are found to be comparable to inelastic cross sections; multiple-(2n+2p)-removal cross sections are also large. For the odd-A target, (n+2p) – and (2n+2p) –removal cross sections are of the same order as inelastic cross sections. The results are compared with previously reported hadron–induced α–particle–removal cross sections. (auth)

11405 TWO-PARTICLE TRANSFER IN (^{6}Li,d) AND (^{7}Li,t) REACTIONS. Dolinskii, E. I.; Turovtsev, V. V.; Yarmukhamedov, R. (Inst. of Nuclear Physics, Moscow). Yadern. Fiz.; 19: No. 5, 1003-1018(May 1974). (In Russian).

Using a simple dispersion model the contributions from the α-particle transfer and the t + p and h + n transfers to the differential cross sections of (d, ^{6}Li), (^{6}Li, d), (^{7}Li, t) and (h, ^{7}Be) reactions on light nuclei are calculated. It is shown that the account of the t + p and h + n transfers improves the fit for the angular distributions. An empirical information on the ^{6}Li → α + d and ^{7}Li → α + t vertex constants is obtained. (auth)

11406 FORM FACTORS FOR ELECTRON SCATTERING OF CARBON NUCLEUS IN THE α-CLUSTER PROJECTION MODEL. Inopin, E. V.; Luk'yanov, V. K.; Pol, Yu. S. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 19: No. 5, 987-1002(May 1974). (In Russian).

Charge form factors are studied for elastic (0^+) and inelastic electron scatterings on the ^{12}C nucleus with excitation of rotational states 2^+ and 3^- in framework of the α-cluster projection model. As the nucleon test functions in the α clusters the s-state functions are chosen with Gaussian and exponential asymptotics and whose parameters may be fixed from the elastic scattering on the ^{4}He nucleus. Detailed comparison with the experiment is presented at all known momentum transfers up to 3.5 fm^{-1}. A model ambiguity in description of the observed form factors is detected. It is shown that for excited states of the ^{12}C nucleus the α clusterization is amplified as compared with the ground state. (auth)

11407 SHELL-MODEL APPROACH FOR THREE-BODY FINAL STATES. Grauel, A. (Univ., Frankfurt am Main). Z. Naturforsch.; 28a: No. 2, 185-205(Feb 1973). (In German).

A scattering theory for reactions with three-particle channels above the two-particle threshold is developed. The R-matrix-technique is used for the calculation of the extended S-matrix. Correlated two-particle wave functions in the exit channels are employed to describe the exact two-particle continuum. For the usual shell model only a few partial waves dominate. The cross section depends on the energy-distribution between the two outgoing nucleons. Numerical results are presented for the model (d,2n)-reaction exciting 0^+-states in ^{16}O without Coulomb-effects. The treatment is restricted to three (2p,2h)-states with the particles in the (sd)-shell and holes in the p-shell. (GE)

11408 MEAN FISSION NEUTRON CROSS-SECTION FOR THE REACTION ^{19}F(n,2n)^{18}F. de Regge, P.; Dams, R.; Hoste, J. (Ghent State Univ.). Radiochim. Acta; 19: No. 3, 100-101(1973).

The cross section for the reaction ^{19}F(n,2n)^{18}F averaged over the fission neutron-spectrum was determined experimentally from the absolute ^{18}F activity induced in reactor irradiated NH_4F. For this purpose a procedure for a fast fluoride purification based upon cation exchange was developed. A cross section of 7.10 ± 0.06 μbarn was obtained. (GE)

11409 SPIN–ORBIT INTERACTION IN HEAVY-ION ELASTIC SCATTERING. Kaneko, T. (Niigata Univ., Japan). Progr. Theor. Phys. (Kyoto); 50: No. 5, 1765-1766(Nov 1973).

A preliminary calculation was made on ^{14}N + ^{14}N and ^{14}N + ^{16}O elastic scattering through the use of the optical model with the spin–orbit interaction. The differential cross sections for the first reaction at 17.7 MeV and the second at 18.3 MeV are plotted. (JFP)

11410 REACTION ^{10}B(^{16}O,α)^{22}Na. Gomez del Campo Estrada, J. Mexico City; Universidad Nacional Autonoma de Mexico (1973). 52p. (In Spanish).

Thesis.

The ^{10}B(^{16}O,α)^{22}Na reaction was studied with the purpose of determining possible mechanisms of this reaction and to study the spectroscopy of ^{22}Na. The experimental procedure used for the study is described in detail. Excitation functions were measured at bombardment energies from 40 to 46 MeV in steps of 200 keV. The angular distribution was measured at 46 MeV in order to detect possible asymmetries around 90° center of mass. With the excitation functions the data can be averaged in a wide energy range and the results can be compared with fluctuation analyses and with Hauser–Feshbach calculations. The competitive reactions (^{16}O,d) and (^{16}O,^{6}Li) are analyzed. Comparison of the data with the Hauser–Feshbach calculations and with the predictions of the shell model indicates strongly possible high spin members of the rotational band of the K = 0^+, T = 0 and K = 0^+, T = 0 up to the 10^+ and 9^+ states respectively. (JSR)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 11382, 11386, 11390, 11400, 11404, 11447, 11467, 11519, and 11607.

11411 (AECL-4708, pp 11-12) DECAY OF ^{34}Ar: A MIRROR COMPARISON OF SUPERALLOWED BETA DECAY. Hardy, J. C.; Schmeing, H.; Geiger, J. S.; Graham, R. L. Jan 1974.

11412 (AECL-4708, p 13) HALF-LIFE OF ^{35}S. Schmeing, H.; Hardy, J. C.; Graham, R. L.; Geiger, J. S. Jan 1974.

11413 (ANU-P-586) ALPHA CAPTURE TO THE GIANT QUADRUPOLE RESONANCE. Foote, G. S.; Branford, D.; Shikazono, N.; Weisser, D. C. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Mar 1974. 6p. Dep. NTIS (US Sales Only) $4.00.

Angular distributions have been measured for the reaction ^{28}Si(α, γ_0)^{32}S in the energy range E_α = 12–18 MeV, and the cross sections for exciting 1^- and 2^+ states, deduced. These data together with similar data for ^{28}Si and ^{40}Ca are compared to calculations made using Hauser–Feshbach theory. It is shown that the (α, γ) reaction most probably excites the giant quadrupole resonance. (auth)

11414 (INIS-mf-1303) ALPHA PARTICLE SCATTERING FROM ^{24}Mg NUCLEI. Drentje, A. G. (Rijksuniversiteit Groningen (Netherlands)). 18 Feb 1972. 105p. INIS.

Angular distributions of elastically and inelastically scattered α-particles by ^{24}Mg nuclei were measured at 13 energies between 19.70 and 23.23 MeV. The reaction mechanisms found from the analysis of cross section fluctuations in the energy range where broader structures in the fluctuation curves occur have been studied. Of special interest was the reaction mechanism in the case of inelastic scattering to a 3^+ state in ^{24}Mg; such a process is forbidden as one-step (direct) reaction, but existing measurements at 22.5 MeV showed evidence for a direct process. In the case of elastic scattering a partial wave analysis was applied for: (a) forward scattering angles (Θ < 75°); (b) the full angular range; (c) backward angles (Θ > 140°). The resulting phase shifts η_l for cases (a), (b) and (c) show differences. The reason is that different reaction mechanisms dominate the scattering in the different angular ranges. The η_l values show variations as a function of energy. An interpretation of these variations can be given for backward scattering angles only, where compound nucleus processes are contributing strongly to the differential cross sections. A comparison of energy averaged angular distributions for elastic scattering and calculated distributions based on the optical model and the compound nucleus model shows that for Θ < 75° direct processes are strongly dominating, whereas for Θ > 150° compound nucleus processes are the most important. The deformation of the ^{24}Mg nucleus can be deduced from the strength of the inelastic scattering process; the result agrees well with results found in different methods. Calculation of compound nucleus differential cross sections show that these processes contribute strongly to the inelastic scattering for Θ > 90°. (auth)

11415 (INIS-mf-1304) CROSS SECTION FLUCTUATIONS IN ALPHA PARTICLE SCATTERING BY ^{24}Mg, ^{26}Mg, AND ^{28}Si.

Roeders, J. D. A. (Rijksuniversiteit Groningen (Netherlands)). 19 Feb 1971. 133p. INIS.

Averaged properties of highly excited compound nucleus states were evaluated from an analysis of fluctuations observed in nuclear reaction cross sections as a function of energy. Studied are the elastic and inelastic scattering of alpha particles by ^{24}Mg, ^{26}Mg and ^{28}Si at bombarding energies ranging from 18 to 28 MeV. The experimental set up was described. A method is given to perform a fluctuation analysis when effects of nonstatistical origin are present in the excitation functions. A new "reduced" excitation function is constructed by dividing every experimental point of the original excitation function by the average value of neighboring points. By choosing an appropriate value of the averaging interval reduced excitation functions are obtained which yield undistorted autocorrelation and distribution functions. The coherence width is obtained with the autocorrelation method, and also from the number of maxima present in excitation functions. The amount of direct interaction y_D is obtained from the distribution of the cross sections. The experimental coherence width values, which ranged from 81 to 116 keV for the compound nucleus ^{28}Si, from 83 to 94 keV for ^{30}Si and from 51 to 69 keV for ^{32}S at excitation energies between about 23 and 33 MeV are compared with theory. The rather small increase of the experimental values with energy can be explained rather well when the level density is calculated according to the back shifted Fermi gas model, and a nuclear moment of inertia is introduced, which is energy dependent. In the energy region studied the direct interaction mechanism governs the elastic alpha particle scattering and the inelastic scattering to the lowest excited 2^+ and 0^+ states of ^{24}Mg, ^{26}Mg, and ^{28}Si. The experimental values of the effective number of reaction channels agree well with theoretical calculations of N_{eff}. (auth)

11416 (MATSCIENCE-78, pp 98-109) STUDIES IN STRIPPING AND PICKUP REACTIONS. Puttaswamy, N. G. (Bangalore Univ., India). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The spectrum of helium-3 particles from the ^{37}Cl(d,^{3}He)^{36}S reaction at 23.35 MeV and 21° and the differential cross sections for this reaction are measured. The spectroscopic factors are also calculated for the ^{37}Cl(^{3}He,d)^{38}Ar reaction. (JFP)

11417 (ORNL-TM-4544) GAMMA-RAY PRODUCTION DUE TO NEUTRON INTERACTIONS WITH MAGNESIUM FOR INCIDENT NEUTRON ENERGIES BETWEEN 0.8 AND 20 MeV: TABULATED DIFFERENTIAL CROSS SECTIONS. Dickens, J. K.; Love, T. A.; Morgan, G. L. (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W-7405-eng-26. 111p. Dep. NTIS $8.50.

Numerical values of differential cross sections for gamma rays produced by neutron reactions with magnesium were obtained for neutron energies between 0.76 and 20 MeV. The cross-section values were obtained by using a NaI spectrometer. These data consist of the production of gamma rays by neutron reactions with values of $d^2\sigma/d\omega dE$ for θ_γ = 125 and 90 deg and for $0.7 \leq E_\gamma \leq 10.5$ MeV, with gamma-ray intervals ranging from 20 keV for $E_\gamma \leq 1$ MeV to 160 keV for $E_\gamma \approx 9$ MeV and with neutron energy intervals varying from ~0.25 MeV for E_n = 0.76 to 1.5 MeV to 3 MeV for E_n = 14 to 20 MeV; and values of $d\sigma/d\omega$ for E_γ = 1.37 MeV for θ_γ = 125 deg and for E_n between threshold and 6.0 MeV and for E_γ = 1.81 MeV for θ_γ = 125 deg and for E_n between threshold and 3.2 MeV. (52 figures, 45 tables) (auth)

11418 ^{24}Mg(^{3}He,n)^{26}Si AND ^{28}Si(^{3}He,n)^{30}S STRIPPING REACTIONS. Abbondanno, U. (Univ., Trieste, Italy); Demanins, F.; Lagonegro, M.; Nardelli, G. Nuovo Cim.; 21A: No. 3, 518-528 (1 Jun 1974).

The ^{24}Mg(^{3}He, n)^{26}Si and ^{28}Si(^{3}He, n)^{30}S two-nucleon stripping reactions were studied at incident energies of $E_{^3He}$ = 4.7 and 5.5 MeV, using the pulsed-beam time-of-flight technique. The angular distributions were obtained in an angular range from θ_L = 0° to θ_L = 150° (in the laboratory system) for the neutrons from the ground state ($J^\pi = 0^+$), the first excited state ($J^\pi = 2^+$, E_x = 1.79 MeV) and the second excited state ($J^\pi = 2^+$, E_x = 2.78 MeV) of ^{26}Si; and for the neutrons from the ground state ($J^\pi = 0^+$) and the first excited state ($J^\pi = 2^+$, E_x = 2.21 MeV) of ^{30}S. A description of the results is presented in terms of the distorted-wave Born approximation and compound nucleus formalism and relative spectroscopic factors are deduced for the various levels concerned with the measurements. (auth)

11419 PREDICTION OF WEAK-COUPLING STRUCTURE FROM A SHELL-MODEL BASIS. Wildenthal, B.H.; Nann, H. (Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824); Seth, K.K. Phys. Rev. Lett. 32: No. 14, 794-797 (8 Apr 1974).

Mixed-configuration shell-model wave functions predict the sort of two-nucleon transfer phenomena which has been interpreted as evidence for weak coupling to excited 0^+ states. (auth)

11420 OBSERVATION OF THE CHARGE-EXCHANGE MODE OF THE GIANT M1 RESONANCE OF ^{28}Si. Flynn, E.R.; Sherman, J.; Stein, N. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Rev. Lett. 32: No. 15, 846-848 (15 Apr 1974).

The reaction ^{28}Si(t,^{3}He)^{28}Al has been performed at a bombarding energy of 23.5 MeV. A number of low-lying 1^+ states are observed in the spectrum of ^{28}Al and these are related by the Coulomb energy difference to their analog 1^+, T=1 states which comprise the giant M1 resonance structure of ^{28}Si. Of particular importance, the (t,^{3}He) strength distribution to the 1^+ states in ^{28}Al largely reproduces the distribution of electromagnetic transition rates of their analogs in Si. This provides strong evidence for the existence of the charge-exchange mode with ΔT_z=1 of the giant M1 resonance in ^{28}Si. (auth)

11421 HIGH ENERGY REACTIONS AND NUCLEAR DENSITIES. Auger, J. P. (Laboratoire de Physique, Orleans, France); Lombard, R. J. Nuovo Cim.; 21A: No. 3, 529-555 (1 Jun 1974).

Two kinds of nuclear densities, corresponding to two different approaches to the nuclear many-body problem and characterized by two different surface shapes are used to calculate high-energy reactions. The calculations are made in the framework of the multiple-scattering theory. It is shown that proton-nucleus elastic scattering is suitable to study the surface of particle distributions in nuclei. Low-resolution experiments in which the total differential scattering cross section is measured are sensitive to radii and not to details of nuclear densities. Particle production processes are also briefly discussed. (auth)

11422 STUDY OF EVEN-ODD NUCLEI WITH N OR Z = 11 AND 13. Lambert, M. (Universite de Lyon, Villeurbanne, France); Midy, P.; Desgrolard, P. Phys. Rev., C; 8: No. 5, 1728-1756(Nov 1973).

The 10 even-odd nuclei with an odd number of nucleons, ξ = 11: ^{19}O, ^{21}Ne, ^{21}Na, ^{23}Na, ^{23}Mg; and ξ = 13: ^{23}Ne, ^{25}Mg, ^{25}Al, ^{27}Al, ^{27}Si were studied in the framework of the Bohr-Mottelson and Nilsson models. Two different methods of calculation were used for the energies and wave functions of positive- and negative-parity states. The ground-state static moments and M 1-E 2 transition rates were computed. A minimum number of phenomenological parameters were used. It was confirmed that these nuclei (except ^{19}O) show an equilibrium prolate deformation and can be well accounted for by the model, especially as concerns the positive-parity particle states. Difficulties arise for most of the hole states and negative-parity particle states. Parameters are found to be in the same range for all nuclei. General conclusions on the validity of the model were discussed in the lower part of the 2s-1d shell. (19 figures 11 tables, 78 references) (auth)

11423 ISOSPIN DEPENDENCE OF THE NUCLEAR LEVEL WIDTH. Kildir, M.; Huizenga, J. R. (Univ. of Rochester, New York). Phys. Rev., C; 8: No. 5, 1965-1967(Nov 1973).

Statistical fluctuation analyses of ^{31}P(p, α) and ^{31}P(p, p') excitation functions are used to deduce level widths for the $T_<$ and $T_>$ isospin states in ^{32}S at 17.8 MeV of 38.7 ± 2.7 and 26.2 ± 3.5 keV, respectively. These two widths in ^{55}Mn at 17.6 MeV are reported also. Relative level densities of the two isospins are calculated for each nucleus. (1 figure 2 tables) (auth)

11424 PARTICLE EMISSION FROM HIGH EXCITATION IN THE ^{40}Ca SYSTEM. Hopkins, F. (Kansas State Univ., Manhattan); Eck, J. S.; Elliot, D. O.; Richard, P.; White, J. R. Phys. Rev., C; 8: No. 5, 1721-1727(Nov 1973).

Reaction products from compound-nucleus formation via the ^{16}O + Mg and ^{12}C + ^{28}Si reactions were identified by means of γ-ray-γ-ray coincidence techniques. For bombarding energies in the ranges 24 MeV $\leq E_C \leq$ 26 MeV and 30 MeV $\leq E_O \leq$ 40 MeV, the light-particle emission consists largely of the (2p), (pn), and (αp) modes. The data also suggest that single-proton and single-neutron emissions take place. The relative cross sections for certain of the γ rays associated with the (2p) and (pn) processes imply a steadily increasing fusion cross section over the 30- to 40-MeV range. (5 figures, 5 tables) (auth)

11425 NEUTRON RESONANCE SPECTROSCOPY. XIII. Na to 320 keV. Rahn, F.; Camarda, H. S.; Hacken, G.; Havens, W. W. Jr.; Liou, H. I.; Rainwater, J.; Singh, U. N. (Columbia Univ., New York). Phys. Rev., C; 8: No. 5, 1827-1832(Nov 1973).

Results are presented of measurements of the total cross section vs energy, which was measured to 320 keV for pure metallic sodium. R-matrix fits were made to the seven prominent observed resonances. The best-fit parameters for (E_0, Γ, J,.l) for each resonance are as follows: (2.850, 0.400, 1, 0); (53.15, 1.08, 2, 1); (199.0, 4.5, 1, 0); (212.5, 15, 0, 1); (238, 3.9, 2, 1); (242, 3.5, 0, 1); (297, 1.8, 2, 0), where E_0 and Γ are in keV. Three levels are assigned to be s levels, and four to be p levels. This gives

$10^4S_0 = 0.24\ (1^{+}_{-}{}^{+}_{-})$ and $10^4S_1 = 2.06(1^{+}_{-}{}^{+}_{-})$. The S_1 evaluation includes the presence of weak p levels seen in capture measurements by others. (3 figures, 2 tables) (auth)

11426 NEUTRON RESONANCE SPECTROSCOPY. XIV. Potassium. Singh, U. N.; Garg, J. B. (Columbia Univ., New York); Liou, H. I.; Hacken, G.; Slagowitz, M.; Rahn, F.; Rainwater, J.; Makofske, W. Phys. Rev., C; 8: No. 5, 1833-1836(Nov 1973).

Results are presented of high-resolution transmission measurements using pure natural K metal samples. The measured total σ vs E to 400 keV is given, and resonance parameter evaluations are given for 65 resonances below 200 keV. The isotope assignments, A = 39 or 41, are mainly based on recent unpublished measurements of Good and Harvey at the Oak Ridge Electron Linear Accelerator using separated K isotope samples. Values of level strengths, $ag\Gamma_n$, are mainly based on transmission dip area analysis, which with evidence from the resonance shape and peak cross sections permits assignment of l and J for most resonances, and A for many of the resonances not identified in the separated isotope measurements. The following s and p strength functions were obtained: $10^4S_0 = (0.66^{+0}_{-0}{}^{+}_{-})$, $(0.78^{+}_{-}{}^{+}_{-})$, and $10^4S_1 = (1.8^{+}_{-}{}^{+}_{-})$ and $(2.4^{+}_{-}{}^{+}_{-})$ for ^{39}K and ^{41}K, respectively. (3 figures, 2 tables) (auth)

11427 MASS OF ^{31}S. Moalem, A.; Wildenthal, B. H. (Michigan State Univ., East Lansing). Phys. Rev., C; 8: No. 5, 1961-1962(Nov 1973).

A high-resolution study of the $^{32}S(p,d)^{31}S$ reaction shows a discrepancy with the current table of mass values. The $^{32}S(p,d)^{31}S$ reaction Q value is found to be -12817.8 ± 1.5 keV, 45.6 keV more positive than the published value, which carried an 11-keV uncertainty. Similar studies of the (p,d) reaction on ^{23}Na, ^{27}Al, ^{33}S, ^{34}S, ^{35}Cl, and ^{37}Cl indicate no discrepancies with the Q values (of 1- to 2-keV accuracy) tabulated for these nuclei. Possible sources for the sulfur discrepancy are discussed. (auth)

11428 STATES OF ^{25}Al UP TO 7.8 MeV EXCITATION AND THE MASS OF ^{25}Al. Browne, C. P.; Goss, J. D.; Rollefson, A. A. (Univ. of Notre Dame, IN). Phys. Rev., C; 8: No. 5, 1805-1812 (Nov 1973).

Accurate excitation energies were measured for 42 states in ^{25}Al. The ones below 3.7 MeV were measured with both the $^{24}Mg(^3He,d)^{25}Al$ and $^{28}Si(p,\alpha)^{25}Al$ reactions to an accuracy of 2.5 keV or better. Excitation energies between 3.7 and 7.9 MeV were measured with the first reaction only. Uncertainties for the narrow states range from 2.5 to 7 keV with two exceptions. Nine states were found to have natural widths greater than 15 keV, and these were measured. The agreement with previous work is excellent in the region below 3.7 MeV, and is especially good with four excitation energies deduced from γ-ray energy measurements. Nine new states were found between 3.7 and 7.9 MeV, and above 5 MeV the accuracy is much better than that previously reported for all but the known state at 6.3 MeV. Ground-state Q values of -7709.3 ± 2.6 keV for the $^{28}Si(p,\alpha)^{25}Al$ reaction and -3218.0 ± 4.5 keV for the $^{24}Mg(^3He,d)^{25}Al$ reaction were found. These results agree within 0.3 keV as to the mass of ^{25}Al, but the value is 5.3 keV lower than that in the latest mass compilation. (5 figures, 2 tables) (auth)

11429 COUPLED-CHANNEL-BORN-APPROXIMATION ANALYSIS OF ONE-NUCLEON TRANSFER REACTIONS TO ^{25}Mg AND ^{25}Al. Abdallah, A. K. (Univ. of Texas, Austin); Udagawa, T.; Tamura, T. Phys. Rev., C; 8: No. 5, 1855-1865(Nov 1973).

A simple formulation of the coupled-channel Born approximation is presented, for the case where the spin-dependent term in the optical potential can be ignored. The formalism is particularly useful in reducing the computer time required when numerical calculations are carried out for one-particle-transfer reactions. The formalism is then applied to calculate one-particle-pickup and -stripping reactions such as (p,d), (^{3}He,α), (d,t), and (^{3}He,d), all leading to the 1.61-MeV $\frac{1}{2}^+$ and the 3.4-MeV $\frac{3}{2}^+$ states, together with the $\frac{5}{2}^+$ ground states in mass-25 nuclei. It is shown that the observed cross sections are all well reproduced by the coupled-channel–Born-approximation calculations. (5 figures, 4 tables) (auth)

11430 ACTIVATION CROSS SECTIONS OF (n,γ) REACTIONS AT 14 MeV. Vuletin, J. (Electrical Engineering, Split, Yugoslavia); Kulisic, P.; Cindro, N. Lett. Nuovo Cim.; 10: No. 1, 1-3 (4 May 1974).

Activation measurements are reported for nine 14-MeV (n,γ) cross sections. The isotopes magnesium-27, chlorine-37, titanium-50, manganese-55, arsenic-75, iodine-127, barium-138, praseodymium-141, erbium-170 are studied. All the cross sections showed marked differences with the corresponding integration values. (JFP)

11431 ALPHA CAPTURE TO THE GIANT DIPOLE RESONANCE. Foote, G. S.; Branford, D.; Weisser, D. C.; Skikazono, N.; Huang, F. C. P. (Australian National Univ., Canberra). J. Phys., A (London); 7: No. 1, L4-L7(1 Jan 1974).

Cross sections for α capture to the giant dipole resonances of 1d2s and 1f2p shell nuclei are shown to be in agreement with Hauser-Feshbach (Phys. Rev.; 87: 366 to 73 (1952)) calculations. Isospin mixing in ^{28}Si, ^{32}S and ^{40}Ca is discussed. It is shown that α capture data do not provide a conclusive test for the proposed isosplitting of the ^{60}Ni and ^{42}Ca giant dipole resonances. (auth)

11432 NUCLEAR POLARIZABILITIES AND STATIC QUADRUPOLE MOMENTS OF LIGHT NUCLEI. Haeusser, O. (Atomic Energy of Canada, Chalk River, Ont.). J. Phys. Soc. Jap., Suppl.; 34: 135-143(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

In Coulomb excitation the polarization of a nucleus in the electric field of the partner in the scattering process leads to a reduction of the cross section for E2 excitation. First experimental evidence for this polarization effect in the projectile excitation of ^{6,7}Li is presented. Its implication for reorientation experiments in light nuclei is discussed. (9 figures) (auth)

11433 MEASUREMENT OF THE SPIN AND NUCLEAR MAGNETIC MOMENT OF 345 MSEC ^{36}K. Schweickert, H. (Kernforschungszentrum, Karlsruhe, Ger.); Dietrich, J.; Neugart, R.; Otten, E. W. J. Phys. Soc. Jap., Suppl.; 34: 164-166(1973). 164-166(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11434 NUCLEAR ELECTRIC QUADRUPOLE MOMENT OF THE β-EMITTER ^{20}F. Ackermann, H.; Dubbers, D.; Grupp, M.; Heitjans, P.; zu Putlitz, G.; Stoeckmann, H. J. (Univ., Heidelberg). J. Phys. Soc. Jap., Suppl.; 34: 215-216(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Polarized ^{20}F nuclei were produced in a tetragonal MgF_2 single crystal by capture of polarized neutrons. Nuclear magnetic resonance transitions were observed by means of β-decay asymmetry at an external field H = 4350 Oe. The quadrupole coupling constant of ^{20}F in MgF_2 was found to be $|e^2qQ/h| = 5.77(2)$ MHz; and the quadrupole moment, $|Q(^{20}F)| = 0.064(20)$ b. (1 figure) (RWR)

11435 MIRROR MOMENTS AND EFFECTIVE G-FACTORS FOR NUCLEONS IN NUCLEI. Sugimoto, K.; Tanihata, I. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap., Suppl.; 34: 245-248 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11436 LIFETIME OF THE FIRST EXCITED STATE IN ^{35}Ar. Itahashi, T.; Shibata, T.; Wakatsuki, T. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap., Suppl.; 34: 251-252(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11437 MAGNETIC MOMENTS OF DEFORMED NUCLEI. Lee, K. (Marquette Univ., Milwaukee, WI). J. Phys. Soc. Jap., Suppl.; 34: 434(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11438 MAGNETIC MOMENTS OF $d_{\frac{5}{2}}$ NUCLEI AND K ISOTOPES. Arita, K. (Aoyama Gakuin Univ., Tokyo). J. Phys. Soc. Jap., Suppl.; 34: 513-515(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11439 PROJECTED HARTREE–FOCK CALCULATIONS OF SPIN–ISOSPIN MATRIX ELEMENTS IN A = 17–27 NUCLEI. Yoro, K. (Osaka Univ.); Une, T. J. Phys. Soc. Jap., Suppl.; 34: 535-536(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11440 NUCLEAR MOMENTS OF CONJUGATE NUCLEI. Nojiri, Y. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap., Suppl.; 34: 610-618(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11441 SINGLE-NUCLEON REMOVAL ENERGIES. Wagner, G. J. (Max-Planck-Institut fuer Kernphysik, Heidelberg). pp 16-57 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

A survey is given of measurements of nucleon separation energies from occupied shells. Particular emphasis rests on the results of pick-up experiments and recent quasi-free scattering experiments, which have considerably improved knowledge of nuclear hole states. In ^{40}Ca the average separation energy of 1s protons has been found to be 50 MeV (rather than 80 MeV). Similarly, the average separation energy of a $1p_{\frac{1}{2}}$ proton from ^{28}Si is 16 MeV (rather than 25 MeV). Recently, evidence has been obtained for an increase of the 1p spin–orbit splitting from 6.5 MeV in ^{16}O to about 15 MeV in ^{28}Si. Results from pick-up and knock-out experiments are now in full agreement. The relation between the experimental removal energies and single-particle energies from many-body theories is briefly discussed. It is demonstrated that the inclusion of density-dependent interactions improves the results of Hartree–Fock calculations considerably. Finally, the use of model-independent sum rules is recommended for future applications. (17 figures, 2 tables, 88 references) (auth)

11442 STOPPING POWER EFFECTS IN NUCLEAR LIFETIME MEASUREMENTS. Broude, C. (The Weizmann Institute of Science, Rehovoth, Israel). pp 218-235 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

Some recent work on the problems associated with the Doppler-shift-attenuation method (DSAM), the one most widely used for the measurement of nuclear lifetimes, is reviewed. In addition, recent applications of the recoil-distance method that are directed toward making it applicable to shorter lifetimes are addressed. These developments have two aspects: to make it possible to use the recoil-distance method to check the Doppler-shift-attenuation method by producing a range of lifetime where the two methods overlap, and to make possible the application of the lifetime-independent hyperfine interaction experiment, the time-differential method, to levels with shorter lifetimes. Qualitatively similar oscillatory behavior in the mean life as derived from DSAM was observed in ^{7}Li, ^{14}N, ^{22}Ne, ^{27}Al, and ^{31}P. (11 figures, 2 tables) (RWR)

11443 RESONANCES IN ELASTIC SCATTERING OF PARTICLES WITH SPIN ½ AND 0. Ulloa Lugo, N. Y. Mexico City; Universidad Nacional Autonoma de Mexico (1973). 66p. (In Spanish).

Thesis.

General aspects of the theoretical formalism of elastic scattering are presented. The development of a graphic method for the study of resonances, based on the Laubenstein-Laubenstein method, is justified. This method is based on the analysis of experimental data on elastic scattering when the phase and amplitude of each component of the partial salient wave is represented by a vector in the complex plane. The flux diagram and the steps followed for the formulation of an ALGOL program are presented. The operation of the program was proved by the reproduction of previously obtained curves for the ^{28}Si(p,p)^{28}Si reaction. The program is then used to calculate the parameters of the E_p = 0.825 MeV resonance of the ^{24}Mg(p,p)^{24}Mg reaction. Some of the assignments for J^π in other resonances of the same reaction are verified. (tr-auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 10972, 11382, 11388, 11396, 11400, 11403, 11404, 11413, 11423, 11430, 11431, 11435, 11438, 11440, 11441, 11471, 11492, 11508, 11519, 11524, 11579, 11582, 11614, 11623, and 11638.

11444 (ANU-P-588) DEPARTMENT OF NUCLEAR PHYSICS ANNUAL REPORT, 1973. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Jan 1974. 47p. Dep. NTIS (US Sales Only) $5.50.

A brief resume of the operation of the 14 UD Tandem accelerator is given. The research programs in the following topics are outlined: direct reactions; heavy-ion reactions; radiative capture of alpha particles; general nuclear spectroscopy; and beam foil spectroscopy. (AT)

11445 (CONF-740320-2) STATUS OF PREDICTIONS OF PHOTON STRENGTH FUNCTIONS BY GIANT DIPOLE RESONANCE AND VALENCE MODELS. Jackson, H. E. (Argonne National Lab., Ill. (USA)). 1974. 26p. Dep. NTIS $4.50.

From EANDC topical meeting; Tokyo, Japan (27 Mar 1974).

The data available on the strength of radiative transitions from highly excited states in the threshold region are reviewed for nuclei from mass 50 to 250. Photon strength functions for E1 and M1 radiation resulting from measurements of threshold photoneutron spectra, individual neutron spectra, and average capture spectra are summarized. To date neither the single particle nor the giant dipole model has given an accurate description of $\langle\Gamma(E1)\rangle/D$. However, the precision of data on the magnitude and energy dependence of $\langle\Gamma(E1)\rangle/D$ has improved and systematic trends are emerging. Evidence for the importance of single particle effects in the mass region A ≈ 90 is discussed briefly. Data parameterized in terms of the giant dipole prediction appear to be the most satisfactory basis for describing the systematics of $\langle\Gamma(E1)\rangle/D$ in calculating and evaluating gamma-ray spectra and production cross sections. Data for the reaction ^{181}Ta(n,xγ) are discussed. Use of the giant dipole model results in a major improvement in the comparison of calculated and measured spectra. (auth)

11446 (INS-623) REPORT ON THE WORK OF THE INSTITUTE OF NUCLEAR SCIENCES. Progress Report 21, January–June 1973. Rafter, T. A. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Sep 1973. 145p. (SIR(INS)-5). Dep. NTIS (US Sales Only) $10.25.

Brief reports are presented on a number of different topics, including the following: Nuclear physics (accelerator, instrumentation, experimental program, NMR, computers), Radiation research (sources, radiation chemistry of aqueous solutions, radiation mechanism in plastics and solids, applications), Isotope geochemistry — stable isotopes (ores, geothermal studies, hydrological cycle, geochronology), Radioactive dating and fallout (^{14}C, ^{3}H), Radioisotope applications and atmospheric trace gases, Instrumentation, and Theoretical physics. Current research projects, staff, publications, etc., also are listed. (RWR)

11447 (KFK-1607) FLUCTUATION ANALYSIS OF TOTAL NEUTRON CROSS SECTIONS. Kopsch, D.; Cierjacks, S. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Kernphysik). Aug 1971. 7p. INIS.

The total neutron cross sections of the elements F, Na, Al, Si, S, K, Ca, V, Cr, Mn, Fe, Co and Ni were measured in the energy range 0.5–32 MeV by transmission experiments with the time-of-flight facility at the Karlsruhe isochronous cyclotron. Fluctuation analyses of the cross sections were carried out in the energy region between 0.8 and 14 MeV. Above 14 MeV none of the nuclei investigated here exhibited significant fluctuations. The motivation of the analyses were threefold: 1) to determine average level densities, 2) to deduce mean level widths and 3) to search for intermediate structure. (4 figures) (auth)

11448 (MATSCIENCE-78, pp 185-194) SELF-CONSISTENT CALCULATIONS FOR p–f SHELL NUCLEI. Parikh, J. K. (Atomic Minerals Div., DAE, New Delhi). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

A summary is given of work on isotopes of titanium, vanadium, chromium, manganese, iron, cobalt, and zinc for the effects of the addition of a neutron of various nuclear properties. Neutron pickup strengths, $Q_\nu^\dagger$ and BE2 values are included. (JFP)

11449 (ORO-3624-14) NORTH CAROLINA STATE UNIVERSITY NUCLEAR STRUCTURE RESEARCH AT THE TRIANGLE UNIVERSITIES NUCLEAR LABORATORY. Progress Report. Seagondollar, L. W.; Waltner, A. W.; Mitchell, G. E.; Tilley, D. R.; Gould, C. R.; Nelson, R. O. (North Carolina State Univ., Raleigh (USA)). 31 May 1974. Contract AT(40-1)-3624. 28p. Dep. NTIS $4.50.

Brief reports are given concerning work in the following areas: studies of electromagnetic transitions in low–medium nuclei, high-resolution studies, accelerator-induced x-ray studies, nuclear reaction studies, neutron and charged-particle cross section measurements, and development. The reports are abstracts or single-page summaries. Essentially no data are given. (RWR)

11450 IMAGINARY OPTICAL POTENTIAL FROM PARTICLE–VIBRATION INTERMEDIATE STATES. Azziz, N. (Univ. of Puerto Rico, Mayaguez); Mendez-Placido, R. Phys. Rev., C; 8: No. 5, 1849-1854(Nov 1973).

The imaginary part of the optical potential of ^{58}Ni for neutrons is obtained numerically under the assumption that ^{58}Ni is a spherical nucleus characterized by a vibrational spectrum built up from quadrupoles and/or octupoles. The "intermediate" compound states of the n–^{58}Ni system were generated from a strong particle–vibration coupling interaction between the target and the neutron. The calculations were carried out under the assumption that only elastic scattering was permissible. When

compared with phenomenological potentials, the results show a stronger dependence on the structure of the compound nucleus. Some of the characteristics of the A + 1 system, such as the energies of the single-particle states and their splitting into the intermediate compound states, show up clearly through the angular dependence of the Fourier transforms, $W(\vec{k},\vec{k}')$, of the imaginary potential. (1 figure, 1 table) (auth)

11451 SHELL-MODEL STRUCTURE OF ^{49}Ti STUDIED VIA THE (d,t) AND (α,α') REACTIONS. Jamshidi, A.; Alford, W. P. (Univ. of Rochester, New York). Phys. Rev., C; 8: No. 5, 1796-1804(Nov 1973).

Measurements of the ^{49}Ti(d,t) ^{48}Ti reaction were carried out at 18 MeV with an energy resolution of about 10 keV. Single-particle strength distributions for l = 0, 2, and 3 were obtained up to excitation energy of 7 MeV in ^{49}Ti. About 85% of the l = 3 strength was found in states below 3.6 MeV, and the total l = 3 strength was consistent with the sum rule limit for $1f_{7/2}$ transfer to T = 2 states. About three quarters of the sum rule limit for the l = 2 strength (assumed to be $1d_{3/2}$) and half the limit for the l = 0, $2s_{1/2}$ strength was observed, with lower limits for the centroid energies of 5.36 and 5.17 MeV for the $1d_{3/2}$ and $2s_{1/2}$ hole, respectively. Measurements of inelastic α scattering on ^{48}Ti were also carried out at an incident energy of 28.5 MeV with a resolution of 18 keV. These measurements provided many new spin-parity assignments for natural-parity states in ^{48}Ti. In combination with the pickup measurements, they provided indentification for the centroids of the $J^\pi = (2,3,4,5)^-$ states of the $(f_{7/2}^2 \times d_{3/2}^{-1})$ multiplet. (4 figures, 2 tables) (auth)

11452 NUCLEAR SPECTROSCOPY OF ^{42}Ca VIA THE (d,t) (^{3}He,d), AND (α,α') REACTIONS. Jamshidi, A.; Alford, W. P. (Univ. of Rochester, NY). Phys. Rev., C; 8: No. 5, 1782-1795 (Nov 1973).

Measurements of the ^{43}Ca(d,t) and ^{41}K(^{3}He,d) reactions were carried out at incident energies of 20 and 23 MeV, respectively, with an energy resolution of 9 to 14 keV full width at half maximum. Single-particle strength distributions were studied up to an excitation energy of 6.24 MeV in ^{42}Ca. About 75% of the total l = 3 pickup strength was observed in the even-parity states up to the 6^+ state at 3.188 MeV. The other 25% was distributed over 10 states between 3.2 and 6.2 MeV. The l = 2 pickup transitions should populate four T = 1 states of the $[(1f_{7/2})^3 \times 1d_{3/2}^{-1}]$ multiplet with $J^\pi = (2, 3, 4, 5)^-$. The strength was found to be spread over at least 20 states, however, and many transitions showed considerable l = 0 admixture. The stripping measurements also showed extensive fragmentation of the l = 3 strength leading to the negative-parity states of ^{42}Ca, and large differences were observed between the strength distributions observed in stripping and pickup to these states. The particle transfer measurements were supplemented by high-resolution measurements of the ^{42}Ca(α,α') reaction at 28.5 MeV, which provided definite spin-parity assignments to many natural-parity states in ^{42}Ca. (13 figures, 4 tables) (auth)

11453 ELECTROMAGNETIC TRANSITION RATES IN ^{56}Ni. Schulz, N.; Chevallier, J.; Haas, B.; Richert, J.; Toulemonde, M. (Centre de Recherches Nucleaires, Strasbourg). Phys. Rev., C; 8: No. 5, 1779-1781(Nov 1973).

The lifetimes of the first two excited states in ^{56}Ni were investigated by using the reaction ^{54}Fe(^{3}He,nγ)^{56}Ni and the Doppler-shift attenuation method. Pulse-shape discrimination was employed for the neutron-γ-ray coincidence measurements. These measurements led to the following mean lives: τ(2699 keV) = 76^{+40}_{-11} fs and τ(3924 keV) > 1 ps. The E2 transition strength for the $2^+ \rightarrow 0^+$ transition was compared with shell-model predictions. (1 figure) (auth)

11454 NONEQUILIBRIUM CONTRIBUTIONS TO THE ^{51}V(p,n)^{51}Cr REACTION FOR $18 \leq E_p \leq 26$ MeV. Grimes, S. M.; Anderson, J. D.; Davis, J. C.; Wong, C. (Univ. of California, Livermore). Phys. Rev., C; 8: No. 5, 1770-1778(Nov 1973).

Neutron spectra from the ^{51}V(p,n)^{51}Cr reaction were measured at bombarding energies of 18, 20, 22, 24, and 26 MeV. The portion of the spectra corresponding to residual excitations of 10 MeV or less was compared to a shape calculated under the assumption that the residual levels are two-exciton proton-particle-neutron-hole states. Good agreement was obtained at 22, 24, and 26 MeV, but the spectra at lower bombarding energy could be fitted only with the addition of contributions from four-exciton states. The inclusion of pairing effects improved the agreement between the calculation and the data. The data were also compared with a calculation with the hybrid model for preequilibrium reactions; good agreement was observed. (13 figures) (auth)

11455 DISTORTED-WAVE BORN-APPROXIMATION ANALYSIS OF THE ^{42}Ca(p,α)^{39}K REACTION USING AN IMPROVED FORM FACTOR. Falk, W. R. (Univ. of Manitobe, Winnipeg, Canada). Phys. Rev., C; 8: No. 5, 1757-1769(Nov 1973).

An improved method of calculating the form factor for the distorted-wave Born-approximation treatment of (p,α) reactions is described that incorporates explicitly the nuclear structure information. The improvement over earlier treatment of the (p,α) reaction is achieved by carrying out a transformation to center-of-mass and internal coordinates of the transferred nucleons, whose individual wave functions are calculated in a Woods-Saxon potential. The formalism is applied to an analysis of the ^{42}Ca(p,α)^{39}K reaction performed at a proton bombarding energy of 40.2 MeV. Relative proton spectroscopic factors are deduced for the relatively pure single-hole states at 0.0 ($3/2^+$) and 2.52 ($1/2^+$) MeV in ^{39}K. Good agreement with the proton spectroscopic factors from the ^{40}Ca(d,^{3}He)^{39}K reaction is achieved. The $5/2^+$ states in ^{39}K whose structure is largely unknown contain components important to the (p,α) reaction, but not to the (d,^{3}He) reaction, as evidenced by their relatively stronger excitation in the (p,α) reaction. (12 figures, 5 tables) (auth)

11456 EFFECTS OF CORE-EXCITATION IN ^{56,57}Ni AND ^{55}Co. Motoba, T. (Kyoto Univ.); Ogawa, K. Progr. Theor. Phys. (Kyoto); 51: No. 1, 173-192(Jan 1974).

The results of shell-model calculations on ^{56,57}Ni and ^{55}Co nuclei are reported. Effects of one- and two-particle excitation from the $0f_{7/2}$ orbit for ^{56}Ni are considered and those of one-particle excitation for ^{57}Ni and ^{55}Co. Observed low lying spectra are well reproduced by this model. Calculated spectroscopic factors of one nucleon transfer reactions are also in satisfactory agreement with those extracted from experimental data. The ground state of ^{56}Ni is calculated to be a state composed mainly of the closed $0f_{7/2}$ shell component (about 80%). The one-particle excitation is dominant in the 2^+_1 and 4^+_1 states of ^{56}Ni. The single-particle pictures for ^{57}Ni and ^{55}Co are not altered by the introduction of the core excitation. The analyses of coupling schemes in the 2p-1h, 1p-2h and 2p-2h systems have revealed that p-p(h-h) correlations with $J = 0^+$ and 2^+ act as leading interactions, while p-h correlations act as perturbations. Spin-isospin dependence of these p-h correlations is also investigated. (auth)

11457 DECAY OF ^{51}Mn. Ferrer, J. C.; Rapaport, J. (Ohio Univ., Athens). Z. Phys.; 265: No. 4, 365-370(Nov 1973).

The γ-rays from the decay of 46-min ^{51}Mn produced by the ^{50}Cr(d,n) reaction were investigated. Twelve γ-rays were observed. These γ-rays were incorporated into a level scheme of ^{51}Cr with levels at 0, 749.1, 1,164.4, 1,353.3, 1,557.4, 1,899.4, 2,001.4, 2,312.5, and 2,829.7 keV. Branching ratios, log ft values, and J^π assignments are discussed for these levels. The lifetime of the 749.1 keV level was measured to be $T_{1/2}$ 7.6 ± 0.3 ns by utilizing the ^{51}V(p,nγ)^{51}Cr reaction produced by a 3.8 MeV pulsed proton beam. The 749 keV, E2 transition is hindered by a factor of 34 compared to the Weisskopf estimate. (GE)

11458 HALF-LIVES OF ^{51}Cr, ^{54}Mn, ^{59}Fe, ^{65}Zn, ^{86}Rb, AND ^{182}Ta. Visser, C. J.; Karsten, J. H. M.; Haasbroek, F. J.; Marais, P. G. (Fruit and Food Tech. Research Inst., Stellenbosch, South Africa). Agrochemophysica; 5: No. 1, 15-16(1973).

The determination of half-lives for a number of nuclides in a well-type scintillation counter is described. The following values were obtained: ^{51}Cr = 27.75 ± 0.03d; ^{54}Mn = 315.4 ± 0.1d; ^{59}Fe = 44.75 ± 0.04d; ^{65}Zn = 244.52 ± 0.07d; ^{86}Rb = 18.82 ± 0.02d and ^{182}Ta = 114.74 ± 0.08d. (auth)

11459 EXPERIMENTAL FOUNDATIONS OF THE REORIENTATION EFFECT. Kerr, R. G.; Larsen, R. D.; Lutz, W. R.; Thomson, J. A.; Scharenberg, R. P. (Purdue Univ., Lafayette, IN). J. Phys. Soc. Jap., Suppl.; 34: 144-145(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The unambiguous determination of static quadrupole moments by Coulomb excitation depends on the experimental conditions. Several questions bearing on the full potential of the reorientation effect as a method for determining quadrupole moments are addressed. Criteria were obtained which ensure that the effect of the nuclear force is negligible. To calibrate the reorientation effect with traditional measurements, the static quadrupole moment of the ground state of ^{53}Cr was determined. A value of Q = +0.04 ± 0.06 b was found. To crosscheck the reorientation effect further, a precise determination of the quadrupole moment of the first 2^+ state in ^{170}Er was made; Q = 1.95 ± 0.26 b was obtained, in excellent agreement with the rotational value. (1 table) (BWR)

11460 MAGNETIC MOMENT OF β-EMITTER ^{41}Sc. Sugimoto, K.; Mizobuchi, A.; Minamisono, T.; Nojiri, Y. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap., Suppl.; 34: 158-160(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11461 IMPLANTATION TECHNIQUES FOR MEASURING MAGNETIC MOMENTS OF ISOMERIC NUCLEAR STATES. Brenn, R.; Wittemore, A. R.; Sprouse, G. D. (State Univ. of New York, Stony Brook). J. Phys. Soc. Jap., Suppl.; 34: 170-171 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11462 VIOLATION OF THE ADDITIVITY OF THE $1f_{\frac{7}{2}}$ NEUTRON MOMENTS. Nomura, T. (Inst. of Physical and Chemical Research, Wako, Japan). J. Phys. Soc. Jap., Suppl.; 34: 331-337 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The magnetic moment of the ground state in ^{41}Ca shows a rather large deviation from the Schmidt value for a $1f_{\frac{7}{2}}$ neutron, which is a unique configuration for ^{41}Ca if ^{40}Ca is taken as an inert core. In order to investigate the effects responsible for this deviation, it is important to examine whether the quenching observed in the magnetic moment of the ^{41}Ca ground state arises from a basic renormalization; i.e., is this quenching an exceptional case or does it extend essentially unchanged over the whole mass region of the $1f_{\frac{7}{2}}$ shell? This paper discusses the $1f_{\frac{7}{2}}$ neutron magnetic moments from this viewpoint, and summarizes both experimental and theoretical knowledge on this problem. Possible origins of strong violation of additivity for the magnetic moments are considered, although it cannot be concluded definitely that the effective moment of the $1f_{\frac{7}{2}}$ neutron in ^{41}Ca is different from the one in ^{42}Ca or ^{43}Sc. (1 figure) (RWR)

11463 EFFECT OF CORE EXCITATION ON B(E2) VALUES. Bizzeti, P. G. (Univ., Florence). J. Phys. Soc. Jap., Suppl.; 34: 338-343(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

A summary of some experimental facts related to electric quadrupole moments in the ^{40}Ca region is given. Examination of the low-lying levels of $1f_{\frac{7}{2}}$ nuclei having two identical particles or holes with respect to the magic numbers 20 and 28 suggests that such nuclei can be equally well described with the $(f_{\frac{7}{2}})^2$ configuration. While older data supported this conclusion, new measurements on the E2 transitions between high-spin states, the E2 transitions between low-spin states, and the static electric quadrupole moments do not. B(E2) values and effective charges are tabulated and discussed: $(f_{\frac{7}{2}})^2$ configurations with constant effective charge can perhaps describe the N = 28 isotones, but certainly not the A = 42 nuclei. The key to the problem is the presence of additional 0^+ and 2^+ states, which correspond to core-excited states. Since the $(f_{\frac{7}{2}})^2$ states and the additional states are very close together, they mix appreciably, and share the electric quadrupole strength carried by the core-excited configurations. The fact that the sign of the experimental value for Q of ^{42}Ca is opposite to that of the value predicted for the $(f_{\frac{7}{2}})^2$ configuration strongly suggests a considerable mixing of the lowest 0^+ and 2^+ levels with low-lying, intrinsically deformed states. (4 figures, 2 tables) (RWR)

11464 QUADRUPOLE MOMENTS AND COEXISTENCE IN CALCIUM NUCLEI. Cline, D.; Towsley, C. W.; Horoshko, R. N. (Univ. of Rochester, NY). J. Phys. Soc. Jap., Suppl.; 34: 344-349 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Measured static electric quadrupole moments of first excited 2^+ states become increasingly negative as N = 20 is approached, in disagreement with (fp) shell-model calculations. This discrepancy indicates appreciable core excitation. A model is presented containing $(fp)^2$ states and complex configurations of core-excited states, mixed by some residual interaction to produce the physically observed pair of states for that J value. Energy levels in ^{40}Ca and ^{42}Ca are plotted to illustrate the rotational bands in these nuclei. The observation of enhanced in-band E2 transitions is the only sure identification of a rotational band. It is found that ^{40}Ca and ^{42}Ca have prolate deformation, and the calculated E2 matrix elements agree well with experiment. A plot of centroids and distribution widths of the intrinsic quadrupole moment of the ground and first excited 0^+ states in ^{40}Ca shows the coexistence of spherical and deformed bands very clearly. (4 figures, 2 tables) (BWR)

11465 MEASUREMENTS AND INTERPRETATION OF ELECTRIC MOMENTS IN NUCLEI. Cline, D. (Univ. of Rochester, NY). J. Phys. Soc. Jap., Suppl.; 34: 377-386(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Static electric quadrupole moments of the 2_1^+ states of the even isotopes of Ca, Ti, Cr, Fe, Ni, Ba, Nd, and Sm were measured. A model-independent sum rule method was developed and used to make a direct collective-model interpretation of available electromagnetic data. Shell-model calculations reproduce measured moments for the (1f, 2p) shell nuclei except for the N = 22 and 24 isotones, where considerable core excitation is present. Identical soft prolate deformed bands ($\beta = 0.38$, $\gamma = 18°$) are found to coexist with spherical states in ^{40}Ca and ^{42}Ca. Two collective parameters strongly correlate the E2 properties and low-lying level spectrum in most even-A nuclei. (12 figures) (auth)

11466 MOMENTS OF THE $f_{\frac{7}{2}}$-SHELL NUCLEI. Horie, H.; Oda, T. (Tokyo Inst. of Tech.). J. Phys. Soc. Jap., Suppl.; 34: 521-523(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japn (4 Sep 1972). See CONF-720932-.

11467 MAGNETIC MOMENTS OF THE $1f_{\frac{7}{2}}$ NUCLEI. Nomura, T. (Inst. of Physical and Chemical Research, Wako, Japan). J. Phys. Soc. Jap., Suppl.; 34: 619-622(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11468 DETERMINATION OF NUCLEAR DEFORMATIONS FROM INELASTIC SCATTERING OF HEAVY IONS NEAR THE COULOMB BARRIER. Pelte, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg); Smilansky, U. pp 148-177 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

In view of the success of the Coulomb excitation technique in providing data on nuclear charge deformations, the possibilities of performing Coulomb excitation-like studies at energies slightly above the Coulomb barrier are addressed. In this energy region the nuclear and Coulomb effects have almost the same order of magnitude; hence, studying the interference between them might be a good means of comparing charge and nuclear mass deformations. Recent attempts to investigate the advantages and difficulties encountered in such studies are described. Problems met in elastic scattering are first recounted, and then inelastic reactions that can be characterized as one-step processes are examined. The latter provide a further check on the validity of the theories proposed to explain the elastic scattering data, and to remove some ambiguities inherent in these theories. Finally, multiple-step processes in rotational nuclei are described, with special attention given to the extraction of hexadecapole deformations. Some problems connected with the measurement of the E4 matrix elements in the application of the pure Coulomb excitation technique are discussed, and a comparison between the charge and mass moments is presented. (17 figures, 2 tables) (RWR)

11469 INELASTIC SCATTERING OF α PARTICLES ON THE ISOTOPES ^{46,48,50}Ti. Alekseev, V. V.; Nemets, O. F.; Stryuk, Yu. S.; Tokarevskii, V. V. (Inst. of Nuclear Research, Novosibirsk, USSR). Yadern. Fiz.; 19: No. 5, 949-953(May 1974). (In Russian).

The differential cross sections of inelastic scattering of 27.2 MeV α particles on even isotopes ^{46,48,50}Ti are measured in the angular range 30 to 472.5°. The particles were registrated by semiconductor detectors made of the silicon compensated by lithium. The measurements were simultaneously made at five different scattering angles. The angular distributions for the first 2^+ states of the studied nuclei are fitted by the macroscopic theory of inelastic scattering and by the distorted wave approximation. The values of the quadrupole deformation parameters and the reduced probabilities of the corresponding electromagnetic transitions are obtained. The sensitivity of the calculations to the discrete variety of parameters and to the kind of form factor of the imaginary part of the optical potential is studied. (auth)

11470 NEUTRON TOTAL CROSS SECTIONS OF Sc, V, Cu, AND Rh AT μeV ENERGIES. Dilg, W.; Mannhart, W. (Technische Univ., Munich). Z. Phys.; 266: No. 2, 157-160(Jan 1974).

Neutron total cross sections of the elements Sc, V, Cu and Rh were measured for energies 8 to 500 μeV using the ultracold neutron time-of-flight spectrometer at the Munich research reactor FRM. $1/v$-fits to the total cross sections were carried out, and capture cross sections evaluated with correct ion for the small constributions of incoherent-elastic and thermal-inelastic scattering. Evaluation of the 2,200 m/s capture cross sections gave, Sc, (27.54 ± 0.20) b, V, (5.08 ± 0.025) b, Cu, (3.77 ± 0.025) b, Rh, (144.8 ± 0.7) b. Combining the present estimate of copper and the value (2.17 ± 0.03) b reported for ^{63}Cu by Ryves, one obtains (4.49 ± 0.04) b for the 2,200 m/s capture cross section of ^{63}Cu. (orig.) (GE)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 11140, 11336, 11381, 11430, 11431, 11440, 11445, 11448, 11458, 11467, 11470, 11489, 11508, 11519, 11520, 11524, 11526, 11582, 11614, and 11623.

11471 (COO-1530-43) LOW ENERGY NUCLEAR REACTIONS AND SPECTROSCOPY. Technical Progress Report, September 15, 1973–June 15, 1974. Sarantites, D. G. (Washington Univ., St. Louis, Mo. (USA). Dept. of Chemistry). 15 Jun 1974. Contract AT(11-1)-1530. 43p. Dep. NTIS $5.25.

Studies of compound-nucleus reactions by means of pγ- and nγ-coincidence experiments were continued, and new evidence on the bombardment energy where the compound-nucleus mechanism begins to fail appreciably was obtained. A method that permits the indirect determination of the angular momentum brought in by the reaction, by either the compound nucleus or the precompound decay mechanism, is presented. The first stage of an investigation of the mechanism of the α-induced reactions on ^{54}Fe for energies up to 24 MeV was completed. Extension of these studies for the measurement of the spectra of the emitted particles and of the cross sections to all the identifiable levels in all the possible reaction products was initiated, and some progress along this line is reported. The mechanism of formation of bound states of high spin in reactions such as (α,pnγ) and (α,2pγ) up to 30 MeV was investigated. Information on the γ-cascade lifetimes preceding the population of such states was obtained. Measurements of angular distributions and level excitation functions by the (p,nγ) and (p,p'γ) reactions on ^{61}Ni were completed. From these, the applicability of the Hauser–Feshbach theory for compound-nucleus reactions to the analysis of γ-ray correlations to obtain multipole mixing ratios is discussed in the region where a high density of analog states is excited in the compound nucleus. Several spectroscopic investigations were completed in which in-beam particle and γ-ray spectroscopic techniques were employed, and new studies were begun. Of particular interest is the extension of the Doppler-shift attenuation technique (DSA) to reactions such as (p,nγ) to nuclei as heavy as ^{95}Tc for the purpose of obtaining lifetime information. Details were also worked out for extending the DSA method to the (α,pnγ) and (α,2pγ) reactions at higher energies. The lifetimes of some of the high angular momentum states were determined in nuclei such as ^{56}Co and ^{56}Fe. Finally, four decay scheme studies of ^{103}Pd, ^{103}Ru, ^{77}Br and ^{123m}I were completed. (RWR)

11472 (INIS-mf-937) 22-MeV ELECTRON BREMSSTRAHLUNG SPECTRA IN THICK TARGET. Rodriguez, L. M. M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1971. 92p. (In Portuguese). INIS.

Thesis.

The radiation spectra of electron bremsstrahlung of the linear accelerator of Brazilian Center for Physical Research, operated at 22 MeV, was calculated to allow quantitative uses of the beam. A program for the IBM 1620 computer was developed, applying the Monte Carlo method, including losses by ionization. The results were limited to the energy level of photons from 3 MeV up to the maximum energy. The spectra calculated for a tantalum target of 0.3 cm thickness was used for the quantitative analysis of activation experiments including the ^{133}Cs(γ,n)^{132}Cs, ^{63}Cu(γ,n)^{62}Cu, ^{127}I(γ,n)^{126}I reactions, which cross sections were carefully determined. (auth)

11473 (JINR–P4-7821) PRE-EQUILIBRIUM DECAY MODEL FOR EXCITED NUCLEI. Gudima, K. K.; Ososkov, G. A.; Toneev, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 30p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The model of nuclear decay from preequilibrium state generalizing the exiton model by Griffin-Blann is developed to consider the process of attainment of statistical equilibrium in excited nucleus in terms of random Markovian process. The dynamics of the model is demonstrated. The calculation results are compared with experimental data. (auth)

11474 ELECTRIC POLARIZATION OF Br NUCLEI IN ATOMIC Br AND MOLECULAR LiBr. Bonczyk, P. A. (Univ., Bonn). Z. Naturforsch.; 28a: No. 2, 222-225(Feb 1973).

An explanation is given for the failure to observe the electric polarization of ^{79,81}Br nuclei in atomic Br and molecular LiBr from hfs spectra. (31 references) (auth)

11475 NEUTRON SPECTRA FROM THE ^{59}Co(α,n)^{62}Cu REACTION AT E_α = 17.6 MeV. Alevra, A.; Duma, M.; Lukas, I. R.; Magda, M. T.; Nistor, M. E. Rev. Roum. Phys.; 19: No. 1, 55-61(1974).

Neutron spectra resulting in the ^{59}Co(α,n) reaction at E_α = 17.6 MeV were measured using the time-of-flight method. The analysis of particle spectra was performed in the frame of the evaporation and preequilibrium models, the results being consistent with earlier studies of (α,n) reactions. (auth)

11476 MEASUREMENT OF THE ^{59}Co QUADRUPOLE MOMENT BY OBSERVATION OF THE DEFORMATION EFFECT IN THE ^{59}Co + n TOTAL CROSS SECTION. Fisher, T. R.; Poletti, A. R.; Watson, B. A. (Lockeheed Palo Alto Research Lab., Palo Alto, CA). Phys. Rev., C; 8: No. 5, 1837-1842(Nov 1973).

The deformation effect, $\Delta\sigma_{def}$, in the ^{59}Co + n total cross section was measured at neutron energies of 1.0, 1.2, 1.4, 1.6, 2.0, and 15.9 MeV by employing a single-crystal target with 16% nuclear alignment. The average of the five measurements at energies between 1 and 2 MeV was $\Delta\sigma_{def} = -259 \pm 41$ mb; at 15.9 MeV, $\Delta\sigma_{def} = -87 \pm 42$ mb. These results, when interpreted by using the first-order distorted-wave Born-approximation theory, imply a value of 0.39 ± 0.06 b for the quadrupole moment of ^{59}Co, which is in good agreement with the result of other techniques. (3 figures, 2 tables) (auth)

11477 DECAY OF ^{75}Kr. Roeckl, E.; Lode, D.; Pessara, W. (European Organization for Nuclear Research, Geneva). Z. Phys.; 266: No. 2, 123-128(Jan 1974).

The decay of the isotope ^{75}Kr ($T_{\frac{1}{2}}$ = 4.5 ± 0.3 m) was studied using mass separated sources produced at the ISOLDE facility at CERN. A decay scheme is proposed based on gamma, position, and conversion electron singles and coincidence measurements. The total decay energy was measured to be $Q_{(EC)} = 4.4 \pm 0.2$ MeV. The resulting spin-parity assignments and the absence of a $\frac{9}{2}^+$ isomeric state in ^{75}Br are discussed. (GE)

11478 SHORT-LIVED ISOMERIC STATES EXCITED BY THERMAL NEUTRON CAPTURE. Ivanov, E. A.; Ionescu-Bujor, M.; Stoleriu, C.; Zaharcu, M. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 2, 233-238(1974).

The delayed gamma-gamma coincidence method was applied to measure isomeric states with half-lives in the range 10 ns – 10 μs. Two NaI(Tl) detectors in a low counting high efficiency geometry were used to reduce the random coincidence background. A list of sixteen isomers, observed in different targets, is reported. The results of the measurements are compared to the existing literature data. (auth)

11479 MAGNETIC MOMENTS OF EXCITED $\frac{9}{2}^+$ STATES AROUND A = 70: EXPERIMENTAL VALUES FOR ^{67}Zn AND ^{67}Ge. Bertschat, H.; Haas, H.; Leitz, W.; Leithaeuser, U.; Maier, K. H.; Mahnke, H. E.; Recknagel, E.; Semmler, W.; Sielemann, R.; Spellmeyer, B.; Wichert, T. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). J. Phys. Soc. Jap., Suppl.; 34: 217-220(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Measurements of nuclear magnetic dipole moments of excited $\frac{9}{2}^+$ states by means of perturbed angular distributions following nuclear reactions were performed at the 7-MV van de Graaff accelerator of the Hahn-Meitner-Institut, Berlin. This paper gives a systematic compilation of these moments of $\frac{9}{2}^+$ states of odd-neutron and odd-proton nuclei in the mass region around A = 70. Among them are the as yet unreported moments of the $\frac{9}{2}^+$ states in ^{67}Zn and ^{67}Ge. The aim of these investigations was to study the influence of additional proton and neutron pairs on the magnetic moments and to deduce appropriate configurations for these states by comparing measured values with theoretical predictions. (1 figure, 2 tables) (RWR)

11480 QUADRUPOLE INTERACTIONS OF Ge NUCLEI IN Zn AND Ga FOLLOWING NUCLEAR REACTIONS. Haas, H.; Leitz, W.; Mahnke, H. E.; Semmler, W.; Sielemann, R.; Wichert, T. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). J. Phys. Soc. Jap., Suppl.; 34: 221-222(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The method of time-differential perturbed angular distributions was used to study the quadrupole interaction on isomeric levels. Polycrystalline Zn and Ga targets were bombarded with 13-MeV alpha particles and 6.5-MeV protons, respectively, and the quadrupole interaction of levels in Ge isotopes was studied. Modulation spectra for the $\frac{9}{2}$ levels of ^{69}Ge in Zn and Ga are shown. The ratio of the quadrupole moments was determined to be $Q(^{67}Ge,\frac{9}{2}):Q(^{69}Ge,\frac{9}{2}):Q(^{71}Ge,\frac{9}{2}) = 1.22:1:0.219$ within 2%. The following points should be noted: the target temperature was always near the melting point, and no relaxation effect was observed; the interaction in hcp Zn could be fitted with an axially symmetric electric field gradient (EFG); the Ge isotopes are impurities in Zn and Ga with different excess charges, and the EFG

at these impurity sites depends on the role of the conduction electrons in shielding the crystal field. (1 figure) (RWR)

11481 MAGNETIC MOMENTS OF ISOMERIC 6^- STATES IN ^{66}Cu AND ^{68}Cu. Bleck, J.; Butt, R.; Lindenberger, K. H.; Ribbe, W.; Zeitz, W. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). J. Phys. Soc. Jsp., Suppl.; 34: 254-257(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Jspan (4 Sep 1972). See CONF-720932-.

11482 MAGNETIC MOMENT OF THE 265 keV LEVEL IN ^{75}As. Chopra, R. C.; Tandon, P. N. (Tata Inst. of Fundamental Research, Bombay). J. Phys. Soc. Jap., Suppl.; 34: 416-419(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 10972, 11048, 11336, 11358, 11403, 11421, 11430, 11445, 11465, 11471, 11472, 11478, 11520, 11524, 11526, 11535, 11536, 11578, 11589, 11601, 11614, 11623, 11634, 11635, 11637, and 11711.

11483 (AECL-4708) PHYSICS DIVISION. Progress Report, 1 October-31 December 1973. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1974. 77p. (PR-P-100). Dep. NTIS (US Sales Only) $7.00. AECL $2.00.

Work done in the Nuclear Physics Branch, Neutron and Solid State Physics Branch, Theoretical Physics Branch, and Mathematics and Computation Branch is summarized in brief reports. It was found that the theory which describes excitations in $Mn_{0.95}Zn_{0.05}F_2$ quite well does not do so for $KMn_{0.95}Zn_{0.05}F_3$. A theoretical model to describe the behavior of positronium in small spherical cavities was constructed. Various detectors were made from commercial high-purity Ge for reactor control and nuclear physics research applications; in general, the performance and reliability of these units were satisfactory. More efficient programs for simulating heavy water plants were devised; a dynamic model of the hydraulics of a heavy water plant was completed and tested. The analysis of the two-phase flow conditions encountered during a loss-of-coolant accident was investigated by a simulation method. Four reports containing significant amounts of nuclear physics data are title listed separately. (RWR)

For abstracts of individual papers see: 11411, 11412, 11484, and 11523.

11484 (AECL-4708, p 14) MEASUREMENT OF LIFETIMES AND VACUUM DEORIENTATION OF HIGH SPIN STATES IN ^{130}Ce. Andrews, H. R.; Ward, D.; Costa, J. G.; Geiger, J. S.; Graham, R. L.; Taras, P. (Univ., Montreal). Jan 1974.

11485 (COO-1505-69) DEEXCITATION PROCESSES IN NUCLEAR REACTIONS. Progress Report, May 1, 1973-April 30, 1974. Porile, N. T. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Chemistry). May 1974. Contract AT(11-1)-1505. 26p. Dep. NTIS $4.50.

High and low energy nuclear reaction studies were performed. The high energy projects include a comparative study of the nuclear reactions of silver with 300- and 11.5-GeV protons; a comparative study of cross sections and recoil properties of products in the A = 120-140 mass region from the interaction of ^{238}U with 300- and 11.5-GeV protons; measurement of the charge dispersion and recoil properties of products in the A ~ 131 region from the interaction of ^{197}Au with 11.5 GeV protons; study of the energy dependence of the recoil properties of neutron deficient products with A = 131 from the interaction of ^{238}U with high-energy protons; differential range study of products with A ~ 131 from the interaction of ^{238}U with 11.5 GeV protons; study of a fragmentation product, ^{24}Na, in pion-induced reactions. The low-energy research includes a study of the energy dependence of isospin mixing in the ^{69}Ga compound nucleus; tests of the independence hypothesis in the decay of the ^{49}V, ^{52}Cr, ^{55}Mn, and ^{69}Ga compound nuclei formed in proton- and α-induced reactions; a test of the independence hypothesis in the decay of ^{75}Br formed in reactions induced by ^{12}C and ^{16}O ions. (auth)

11486 (JINR-E4-7812) MIXING OF THE VIBRATIONAL AND TWO-QUASIPARTICLE EXCITATIONS IN ISOTONES N = 80, 82, 84. Vdovin, A. I.; Stoyanov, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

Within the framework of the superfluid nuclear model, there is investigated the influence of the interaction of two-quasiparticle and phonon excitations on the structure of low-lying excited states with $I^\pi = 2^+$, 3^- of nuclei with neutron number N = 80, 82, 84. The energies and some electromagnetic characteristics of these states are calculated. The results obtained are compared with experimental data and other theoretical calculations. (4 tables) (auth)

11487 (JINR-E4-7838) MIXING OF VIBRATIONAL AND TWO-QUASIPARTICLE EXCITATIONS IN Te, Sn, AND Cd ISOTOPES. Vdovin, A. I.; Stoyanov, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

The effect of the interaction of two-quasi-particle and vibrational excitations on the $I^\pi = 2^+$, 3^- state structure in the Te, Sn, and Cd isotopes is studied in the framework of the superfluid nuclear model. It is shown that this interaction is of importance in the formation of the structure of the states in question. The calculated characteristics of the levels (excitation energies, quadrupole moments, and electric transition rates) are compared with experimental data. (3 tables) (auth)

11488 (JINR-E6-7762) ON THE DECAY SCHEMES OF ^{123}Ba AND ^{125}Ba. Arlt, R.; Jasinski, A.; Neubert, W.; Ortlepp, H.-G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The neutron deficient ^{123}Ba and ^{125}Ba isotopes obtained in the ^{114}Sn(^{12}C, 3n) ^{123}Ba and ^{117}Sn(^{12}C, 4n) ^{125}Ba reactions were studied with Ge(Li) detectors. Beta-gamma delayed coincidences were measured using Ne 102 Ge(Li) detectors. On the basis of gamma intensities and energy sums the decay schemes are proposed for ^{123}Ba and ^{125}Ba. (auth)

11489 (LYCEN-7401) ANNUAL REPORT, 1973. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). 1974. 69p. (In French). Dep. NTIS (US Sales Only) $6.50.

Single-page reports are presented on work in the following areas: theoretical nuclear physics, reaction mechanisms, spectrometry by means of reactions, nuclear spectrometry by means of radioactivity, nuclear chemistry, and nuclear techniques and applications. Other sections report on visitor groups and publications. Some of the papers contain significant amounts of data, but it is reasonable to believe that these will appear in final form elsewhere. (RWR)

11490 (MATSCIENCE-78, pp 110-117) BETA SPECTRUM SHAPE AND NUCLEAR STRUCTURE. Nagarajan, T. (Univ. of Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

It is shown that an accurate determination of the spectrum shape and log ft values can lead to a correct elucidation of nuclear structure. An independent determination of the individual matrix elements from the spectrum shape alone is not possible, but in suitable cases, it is always possible to infer model dependent effects from the shape factor and log ft. The beta-minus decay of ^{99}Mo to the levels of ^{99}Tc is found. (JFP)

11491 (ORNL-TM-4589) REPORT TO THE U. S. NUCLEAR DATA COMMITTEE. Perey, F. G. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 30p. Dep. NTIS $4.50.

This is a collection of recent, not generally publicized, cross-section work done at ORNL and recent papers which have been submitted for publication. This report is prepared for the USNDC and includes only material which the author thinks might be of interest to the USNDC Subcommittee members. The memo covers the period of time since the last USNDC meeting. (auth)

For title listing of selected paper see: 11389.

11492 (ORNL-TM-4599) REVIEW OF HEAVY-ION FUSION CROSS SECTION RESULTS. Plasil, F. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 48p. Dep. NTIS $5.50.

The fusion of heavy-ion projectiles with target nuclei is discussed in terms of final measured products, such as evaporation-residue nuclei and fission fragments. Experimental techniques used to obtain evaporation-residue cross sections, such as the track detector, the proportional counter telescope, and γ-ray measurements, are briefly described. Available data from fission and evaporation-residue measurements are reviewed with emphasis on results from the Super-HILAC at the Lawrence Berkeley Laboratory. Limitations on compound-nucleus formation is discussed with reference to such concepts as critical angular momentum, critical distance of approach, and fusion barriers. Limits on the production of evaporation-residue nuclei are discussed in terms of angular-momentum-enhanced fission competition during the de-excitation process. It is shown that in some

cases evaporation-residue cross sections are a function of entrance channel conditions, while in other cases fission competition plays a dominant role. (18 figures, 9 tables) (auth)

11493 (ORO-2408-73) STUDIES OF NUCLEAR PROCESSES. Progress Report, June 1, 1973–May 31, 1974. Clegg, T. B. Ludwig, E. J.; Merzbacher, E.; Shafroth, S. M.; Thompson, W. J. (North Carolina Univ., Chapel Hill (USA)). [nd]. Contract AT(40-1)-2408. 29p. Dep. NTIS $4.50.

The studies of nuclear processes conducted by the Chapel Hill group affiliated with the Triangle Universities Nuclear Laboratory (TUNL) have continued to emphasize the following topics: Polarized Proton Beam Experiments; Polarized Deuteron Beam Experiments; Nuclear Reactions and Scattering with Unpolarized Beams; Ion Source Development and Other Instrumentation; Computer Programming for Nuclear Theory and Reaction Data Analysis; Atomic Effects in Nuclear Bombardment. The Cyclo-Graaff at TUNL and the 4-MeV Van de Graaff accelerator were the primary sources of particle beams. Computations were carried out on the computers at TUNL and at the Triangle Universities Computation Center (TUCC). Many charged-particle and neutron experiments were undertaken jointly with groups from Duke University and North Carolina State University. The research program has aimed at a better understanding of the spin dependence of nuclear interactions revealed in experiments with polarized beams. Collisions between charged particles and complex atoms, leading to inner-shell ionization, were studied in high resolution over a broad energy range. Programs for large-configuration-space shell-model calculations were installed. (auth)

11494 HEAVY-ION-INDUCED SINGLE-NUCLEON TRANSFER REACTIONS IN THE Zr–Mo REGION. Zisman, M. S.; Becchetti, F. D.; Harvey, B. G.; Kovar, D. G.; Mahoney, J.; Sherman, J. D. (Univ. of California, Berkeley). Phys. Rev., C; 8: No. 5, 1866-1891(Nov 1973).

The (^{16}O, ^{15}N) and (^{16}O, ^{15}O) reactions on targets of ^{90,91,94}Zr, ^{92}Mo, and ^{93}Nb were investigated with a 104-MeV ^{16}O beam from the Berkeley 88-in. cyclotron. Spectra for the (^{16}O, ^{17}O) reaction (leading to the ground states of $^{89-93}$Zr) and for the (^{12}C, ^{11}B) reaction on ^{90}Zr and ^{92}Mo at 78 MeV were also obtained. Outgoing heavy ions were detected in the focal plane of a magnetic spectrometer with a Borkowski–Kopp-type position-sensitive proportional counter backed by a plastic scintillator. The (^{16}O, ^{15}N) and (^{16}O, ^{15}O) data indicate a preference for high-angular-momentum transfer similar to (but less pronounced than) that shown by the (α, t) and (α, ^{3}He) reactions on the same targets. No evidence for a multistep excitation of core-excited states is apparent from the present data. (14 figures, 16 tables) (auth)

11495 NUCLEAR PHYSICS AND HIGH ENERGY PHYSICS. Section A. Nuclear Physics. Conference held at Bochum, Germany, March 4–9, 1974. Abstracts of Papers. Weinheim, Ger.; Physik Verlag GmbH (1974). 170p. (In German and English). (CONF-740322-(Absts.)).

11496 ELECTRON–GAMMA DIRECTIONAL CORRELATIONS IN ^{121}Te AND THE INTERNAL CONVERSION PROCESS OF THE 212 keV TRANSITION. Sahota, H. S. (Punjab Univ., Patiala, India). Indian J. Phys.; 47: No. 12, 729-735(Dec 1973).

The 82L–212γ directional correlation on the 11/2–3/2–1/2 cascade in ^{121}Te was measured to check the wide difference in the two previously reported measurements. The 82M–212γ directional correlation is measured for the first time. The internal conversion data reported by Chu et al and Marelius et al are analyzed from the point of view of mixing ratio and penetration coefficient for the 212 keV transition. The mixing ratio obtained from the conversion data agrees well with the one obtained from directional correlation data for a much smaller value of the penetration coefficient λ, then previously arrived at by Marelius et al. From the present work a value of $-3.0 \leq \lambda \leq +4.0$ is obtained, which is more consistent with the small hindrance factor than the previous value. (auth)

11497 NUCLEAR STRUCTURE PARAMETER AND PERCENTAGE E_2-ADMIXTURE FOR THE 35.5 keV TRANSITION IN ^{125}Te FROM AN ANALYSIS OF L-SUBSHELL RATIOS. Ramaniah, K. V.; Reddy, T. S.; Reddy, K. V. (Andhra Univ., Waltair, India). Indian J. Phys.; 47: No. 12, 757-759(Dec 1973).

A careful and accurate evaluation of the M1–E2 mixing ratio and penetration parameter was made using the L-subshell intensity ratios and the internal conversion coefficients and penetration functions. A previous analysis of experimental data are useful for an understanding of the penetration effects in the internal conversion process of the 35.5-keV transition in tellurium-125. (JFP)

11498 LEVELS IN ^{97}Nb BY MEANS OF THE ^{96}Zr(^{3}He,d) REACTION. Medsker, L. R. (Argonne National Lab., IL). Phys. Rev., C; 8: No. 5, 1906-1911(Nov 1973).

The ^{96}Zr(^{3}He,d)^{97}Nb reaction was studied with 22-MeV ^{3}He particles. Experimental angular distributions were analyzed by use of distorted-wave Born-approximation calculations to determine l values and spectroscopic factors. The results are compared with previous data on reactions and β decay. The proton configurations of ^{97}Nb are examined in comparison with neighboring niobium nuclei and recent theoretical results. (auth)

11499 EFFECTIVE M2 AND E3 TRANSITION MOMENTS FOR 1h$_{\frac{9}{2}}$ SINGLE-PROTON STATES. Ejiri, H.; Shibata, T.; Fujiwara, M. (Osaka Univ.). Phys. Rev., C; 8: No. 5, 1892-1895(Nov 1973).

Reduced matrix elements B(M2; 1h$_{\frac{9}{2}}$ – 1g$_{\frac{7}{2}}$) = 11.0 ± 0.6(e$\hbar$/2MC)^2 fm^2 and B(E3; 1h$_{\frac{9}{2}}$ – 2d$_{\frac{5}{2}}$) = (11.6 ± 2.2) × 10^3 e^2 fm^6 in ^{141}Pr were obtained by studying γ rays following the ^{139}La(α,2n)^{141}Pr reaction. Detailed analysis of the M2 and E3 transitions in nuclei with neutron number ≈82 gave effective coupling constants g^{eff}(M2)/g(M2) ≃ 0.22 and g^{eff}(E3)/g(E3) ≃ 3. They were analyzed in terms of the spin–isospin core polarization and the octupole core polarization, respectively. (3 figures, 1 table) (auth)

11500 DECAY OF MASS-SEPARATED ^{93}Y. Talbert, W. L. Jr. (Iowa State Univ., Ames); Hanson, R. J. Phys. Rev., C; 8: No. 5, 1945-1954(Nov 1973).

The levels of ^{93}Zr populated in the β decay of ^{93}Y were deduced from Ge(Li)–Ge(Li) coincidence and Ge(Li) singles γ-ray spectra. Twenty two of the 23 observed γ-ray transitions were placed in a level scheme for ^{93}Zr with 11 excited states. These results are compared with those of previous investigations. A number of corrections, clarifications, and expansions of decay schemes previously reported resulted from the use of high-resolution detectors and a mass-separated source strong enough to permit coincidence studies of the weak as well as the intense transitions. Spin–parity assignments of the ^{93}Zr levels were deduced by using relative γ-ray transition rates, β-decay log-ft values, and the results of nuclear-reaction studies. Possible interpretations of some of the levels are presented, based on shell-model descriptions. (5 figures, 3 tables) (auth)

11501 SHAPE FACTOR OF THE BETA SPECTRUM OF ^{148}Pm. Schuepferling, H. M.; Hoffmann, K. W. (Univ., Stuttgart). Z. Phys.; 266: No. 2, 129-134(Jan 1974). (In German).

The β-spectrum of the 3$^-$ – 2$^+$ transition in the decay of ^{148}Pm was investigated with a 4π-Si(Li)-semiconductor spectrometer in a β-γ-coincidence experiment for the first time. The shape factor was determined: C(W) = 1 – 0.394 W – 0.275/W + 0.044 W^2. The spin and parity of the ground state of ^{148}Pm can be determined to be 3$^-$. The shape of this nonallowed spectrum indicates the existence of the "cancellation" or "selection rule" effect. (GE)

11502 14.8 MeV NEUTRON-INDUCED (n,p) CROSS-SECTIONS IN THE REGION OF THE PROTON MAGIC NUMBER 50. Mavaddat, T.; Rao, S. A.; Kuroda, P. K. (Univ. of Arkansas, Fayetteville). J. Inorg. Nucl. Chem.; 36: No. 5, 953-957(May 1974).

The activation cross sections for several (n,p) reactions in the region of the proton magic number 50 were measured at the neutron energy of 14.8 MeV. The target nuclides studied were: ^{108}Cd, ^{112}Cd, ^{115}In, ^{118}Sn, ^{121}Sb, ^{123}Sb and ^{127}I. The experimental results obtained were compared with the values calculated from a number of semi-empirical equations. The (n,p) reaction cross sections of ^{121}Sb and ^{123}Sb leading to the residual nuclei ^{121}Sn and ^{123}Sn having 50 protons were found to be rather high. (auth)

11503 GAMMA–GAMMA DIRECTIONAL-CORRELATION STUDIES IN ^{143}Pr. Venkataratnam, S.; Satyanarayana, G.; Lakshminarayana, V. (Labs. for Nuclear Research, Visakhapatnam, India). Nuovo Cim.; 21A: No. 4, 687-706(21 Jun 1974).

The gamma-gamma directional correlations on (293–57), (665–57), (881–57), (231–491) and (587–351) keV cascades in ^{143}Pr are studied with high efficiency sum and sum-peak coincidence spectrometers. The correlation coefficients of the cascades are obtained. The spins of the 351, 491, 722 and 938 keV levels in ^{143}Pr are conclusively assigned. The mixing ratios for the 231, 587, 665 and 881 keV transitions are determined. (auth)

11504 RADIOACTIVE DECAY OF ^{110m}Ag. Pratt, W. W. (Pennsylvania State Univ., Univ. Park). J. Inorg. Nucl. Chem.; 36: No. 6, 1199-1200(Jun 1974).

The γ-rays from ^{110m}Ag have been measured with a Ge(Li) spectrometer. Several weak transitions were found which are compared with the results of other recent measurements and with a recently proposed ^{110}Cd level scheme. (auth)

11505 POLARIZATION OF PROTONS FORMED DURING THE ELECTRON SPALLATION OF LIGHT NUCLEI. Tartakovskii, V. K.; Shpinar, L. I. (Kiev State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 31-34(1973). (In Russian).

It was shown that protons formed during the electron spallation of light nuclei can be noticeably polarized. The dependences of the degree of polarization of the protons on their flight angle were found in the coplanar cases. The behavior of the polarization is very sensitive to the selection of the distorted proton wave functions in the finite state. (tr-auth)

11506 NUCLEAR MOMENTS AND NUCLEAR STRUCTURE. Proceedings of the International Conference, Osaka, Japan, September 4–8, 1972. Horie, H.; Sugimoto, K. (eds.). Supplement to Journal of the Physical Society of Japan, Vol. 34. Tokyo; Physical Society of Japan (1973). 650p. (CONF-720932-).

This volume includes all the invited and contributed papers, summaries of the discussions following the oral presentations, and tables of nuclear moments. Separate abstracts were prepared for each of the 54 invited papers; 41 of the contributed papers, which contain significant information, were title listed. (RWR)

For abstracts and title listings of individual papers see: 10474, 10972, 11010, 11377, 11378, 11398–11402, 11432–11440, 11459–11467, 11479–11482, 11507–11519, 11535–11549, 11559–11574, and 11628–11646.

11507 MAGNETIC HYPERFINE STRUCTURE OF MUONIC ATOMS. Wu, C. S. (Columbia Univ., New York). J. Phys. Soc. Jap., Suppl.; 34: 47-62(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The subject of the review is restricted to only the nuclear magnetic moments determined by muonic atoms. The first part of the paper discusses the distribution of nuclear magnetism: elementary theory of hyperfine interaction for distributed magnetism; experimental consideration, results, and their comparison to theoretical calculations; expansion of the M1 hfs studies to 2s → 2p transitions; and the parallel and antiparallel effects of the spin and the orbital angular momentum of the odd proton are covered. The second part of the paper deals with the magnetic moments of the excited nuclear states from the nuclear resonance excitations and from the dynamic E2 excitations. (8 figures, 5 tables) (RWR)

11508 EXPERIMENTAL TECHNIQUES FOR EXCITED-STATE MOMENTS: SCOPE AND LIMITATIONS. Matthias, E. (Freie Univ., Berlin). J. Phys. Soc. Jap., Suppl.; 34: 78-106(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The experimental situation on the measurement of electromagnetic moments of excited nuclear states is discussed for various lifetime ranges. Inherent limitations of all techniques involving radiation are the width of the state, its relative abundance, and radiation damage. Consequences of these limitations are discussed. Briefly presented are the three major techniques: Moessbauer effect, low-temperature nuclear orientation, and perturbed angular correlations with its variations dictated by lifetime, namely, time-integral and time-differential observations and the combination with NMR. An effort is made to select examples which demonstrate recent physical developments as well as significant technical improvements of these methods. (19 figures, 85 references) (auth)

11509 MAGNETIC MOMENTS OF SHORT-LIVED STATES BY USE OF A STOPPER IN THE RECOIL-INTO-GAS METHOD. Miller, T. R.; Bond, P. D.; Little, W. A.; Lazarus, S. M.; Takeda, M.; Sprouse, G. D.; Hanna, S. S. (Stanford Univ., CA). J. Phys. Soc. Jap., Suppl.; 34: 107-112(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Measurements of magnetic dipole moments of very short-lived states were performed with the recoil-into-gas method. A stopper was used to control the flight time of the recoils and hence the time during which the hyperfine perturbation is applied. The hyperfine fields were calibrated by use of nuclear states with known g factors. Results for the $\frac{3}{2}^-$ and $\frac{5}{2}^-$ levels of ^{103}Rh, ^{197}Ag, and ^{109}Ag were compared with the core-excitation model. (6 figures, 1 table). (auth)

11510 ELECTRIC QUADRUPOLE INTERACTION IN THE $\frac{5}{2}^+$ FIRST EXCITED STATE OF ^{111}Cd IN INDIUM. Brandt, D.; Rosenblum, S. S. (Freie Univ., Berlin). J. Phys. Soc. Jap., Suppl.; 34: 178-180(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11511 ELASTIC AND INELASTIC ^{4}He SCATTERING NEAR THE COULOMB BARRIER FROM THE EVEN Cd ISOTOPES. Werdecker, D. (Univ., Cologne); Kleinfeld, A. M.; Greenberg, J. S. J. Phys. Soc. Jap., Suppl.; 34: 195-196(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11512 G-FACTORS OF HIGH SPIN ISOMERIC STATES IN ^{114}Sn AND ^{118}Sn. Borsaru, M.; Herskind, B.; Kalish, R.; Nakai, K. (Neils Bohr Inst., Copenhagen). J. Phys. Soc. Jap., Suppl.; 34: 262-263(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11513 ELECTRIC QUADRUPOLE MOMENT OF THE 2.083 MeV STATE OF ^{140}Ce DERIVED FROM A TDPAC MEASUREMENT. Klemme, B.; Miemczyk, H. (Univ., Bonn). J. Phys. Soc. Jap., Suppl.; 34: 265-266(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11514 NUCLEAR MOMENTS AND RELATED STRUCTURE OF VIBRATIONAL AND TRANSITIONAL NUCLEI. Tamura, T.; Kishimoto, T. (Univ. of Texas, Austin). J. Phys. Soc. Jap., Suppl.; 34: 393-398(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

It is shown that the boson expansion technique describes quite well the transition from vibrational ^{148}Sm to deformed ^{154}Sm. It is also shown that it predicts the large quadrupole moment of the 2_1^+ state of ^{114}Cd, without making the $2_1^+ \rightarrow 0_g^+$ transition probability too large. (3 figures, 2 tables) (auth)

11515 MAGNETIC MOMENTS OF ^{127}Te AND ^{129}Te. Silverans, R. E.; Coussement, R.; Schoeters, E.; Vanneste, L. (Louvain Univ., Belgium). J. Phys. Soc. Jap., Suppl.; 34: 421-422(1973).

11516 STUDY OF THE MAGNETIC MOMENTS OF THE TELLURIUM ISOMERS BY NUCLEAR ORIENTATION. Vanneste, L.; Coussement, R.; Dumont, G.; Pattyn, H.; Schoeters, E.; Silverans, R. E. (Louvain Univ., Belgium). J. Phys. Soc. Jap., Suppl.; 34: 423-424(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11517 MEASUREMENTS OF THE QUADRUPOLE MOMENTS OF ^{124,126,128}Te. Kleinfeld, A. M. (Cologne Univ.); Maeggi, G.; Werdecker, W. J. Phys. Soc. Jap., Suppl.; 34: 440-441(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11518 STUDIES ON ENERGY LEVELS AND ELECTROMAGNETIC PROPERTIES IN N = 82 NUCLEI USING PSEUDO LS COUPLING SHELL MODEL. Nomura, M. (Tokyo Univ.). J. Phys. Soc. Jap., Suppl.; 34: 524-525(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11519 NUCLEAR MOMENTS. Nakai, K. (Tokyo Univ.). J. Phys. Soc. Jap., Suppl.; 34: 602-609(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11520 PROTON, GAMMA ANGULAR CORRELATIONS NEAR ANALOG RESONANCES IN THE MASS 90 REGION. Vager, Z. (The Weizmann Institute of Science, Rehovoth, Israel). pp 74-85 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

The study of nuclear wave functions of low-lying states in the mass-90 region is discussed. The motivation for the work, some experimental results, and a discussion of the interpretation difficulties are given, together with some preliminary results of analysis. Excitation functions of the (p,p'γ) angular correlation through the 0.871-, 1.582-, 1.868-, and 2.08-MeV states of ^{94}Mo are presented. The compound background below the resonances rendered interpretation difficult; therefore, a semiempirical approach was followed. Vector diagrams for the measured wave function components of the $\frac{1}{2}^+$ ground states of ^{87}Sr, ^{89}Sr, ^{93}Mo, ^{93}Zr, ^{95}Zr, ^{99}Mo, and ^{97}Mo are shown. (9 figures, 2 tables) (RWR)

11521 MEASUREMENTS OF ELASTIC QUADRUPOLE MOMENTS BY THE PAC TECHNIQUE. Bodenstedt, E. (Univ. of Bonn). pp 197-217 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

A survey of the present state of the study of electric quadrupole moments of excited nuclei by perturbed angular correlations or angular distributions is given. The method is first described generally, and then the technique is demonstrated with two examples in which the quadrupole moment of an excited state was

derived by differential perturbed angular correlation measurements. The main problem in the derivation of absolute values for the electric quadrupole moment is the calibration of the field gradient. Finally, the kind of nuclear structure information which can be obtained through values for the electric quadrupole moments of excited nuclear states is illustrated by several examples. (13 figures, 2 tables) (RWR)

11522 DELAYED PROTON EMITTER ^{119}Ba. Bogdanov, D. D.; Karnaukhov, V. A.; Petrov, L. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 19: No. 5, 940-942(May 1974). (In Russian).

A new emitter of the delayed protons ^{119}Ba is produced in the reaction ^{106}Cd + ^{16}O. The identification was made by the excitation function. The half-life $T_{\frac{1}{2}} = 5.0 \pm 0.6$ sec and the proton spectrum are measured. Comparison of the shape of the spectrum with the statistical model calculation gives the value of the β decay total energy for electron capture $Q_0 = 7.1 \pm 1.0$ MeV. (auth)

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Refer also to abstracts 9118, 11336, 11430, 11437, 11445, 11458, 11459, 11468, 11470, 11478, 11489, 11492, 11514, 11519, 11521, 11552, 11559, 11589, 11607, 11636, 11637, 11645, and 11697.

11523 (AECL-4708, pp 14-15) LIFETIMES FOR HIGH SPIN STATES IN ^{165}Ho BY DOPPLER BROADENED LINESHAPE ANALYSIS (DBLS). Ward, D.; Andrews, H. R.; Geiger, J. S.; Graham, R. L.; Sie, S. H. (Queen's Univ., Kingston, Ont.). Jan 1974.

11524 (IFA-NR-9-1972) MOESSBAUER ISOTOPE TABLES. Barb, D.; Morariu, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1972. 65p. Dep. NTIS (US Sales Only) $6.25.

By the end of 1971 the Moessbauer effect had been observed in 75 isotopes of 41 elements (some isotopes have more than one Moessbauer transition). Transition energies ranged up to 155 keV. The principal features of the Moessbauer isotopes and their nuclear decay schemes (for low-energy transitions) are presented. (176 references) (RWR)

11525 (JINR-E4-7753) PHENOMENOLOGY OF THE BACK-BENDING AT HIGH SPINS IN NUCLEAR ROTATIONAL BANDS. Nadzhakov, E.; Apostolova, A.; Kitipova, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The representation of the moment of inertia J versus level energy E instead of angular velocity squared ω^2 is proposed to be used for phenomenological parametrization of nuclear rotational energies. In this representation J is a single-valued function (of E) instead of a multivalued function ($\alpha(\omega^2)$). Moreover it exhibits a simpler behavior and may be described by a two-component five-parameter fit, the parameters having a clear physical meaning. All the parameters were deduced from experimental data and compared for several nuclei. One of these parameters can be regarded as a definition of the transition width. Thus the transition width was also obtained from experimental data and discussed. (auth)

11526 (JINR-P6-7849) MEASUREMENT OF THE SUB-MICROSECOND LIFETIMES OF LEVELS BY THE METHOD OF A SINGLE-CRYSTAL SCINTILLATION TIME SPECTROMETER. Budzynski, M.; Buttsev, V. S.; Gromov, K. Ya.; Ion-Mikhai, R.; Kalinnikov, V. G.; Marupov, N. Z.; Morozov, V. A.; Muminov, T. M.; Kholbaev, I.; Yakhim, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

With the help of a single-crystal (scintillation) time spectrometer the lifetimes of excited states in the nuclei ^{79}Kr, ^{135}La, ^{141}Pm, ^{155}Dy, ^{159}Er, ^{161}Er, ^{167}Yb, and ^{169}Tm were measured. (3 figures, 2 tables) (auth)

11527 (JINR-P6-7850) NATURE OF THE 839-MeV LEVEL IN ^{151}Gd. Kuznetsov, V. V.; Morozov, V. A.; Muminov, T. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 9p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The value of α_K is measured for 443.8 keV transition in the ^{151}Gd nucleus. The multipole order, MI, of the transition is found. Based on the experimental results the nature of the 839 keV level in ^{151}Gd is discussed. (auth)

11528 (ORO-4317-39) DEPENDENCE OF SHELL EFFECTS ON NUCLEAR TEMPERATURE. Technical Report 74-098. Mustafa, M. G. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). May 1974. 13p. Dep. NTIS $4.00.

The temperature dependence of shell effects are studied for selected shapes in ^{208}Pb and ^{242}Pu by a generalized Strutinsky method. Contrary to the normal expectation, an increase in the shell correction energy is found for some shapes at low temperature. (auth)

11529 HALF-LIFE OF ^{150}Ce OBTAINED BY SISAK TECHNIQUE. Aronsson, P. O. (Chalmers Tekniska Hoegskola, Goteborg); Skarnemark, G.; Skarestad, M. Inorg. Nucl. Chem. Lett.; 10: No. 6, 499-504(Jun 1974).

The half-life of the previously unidentified nuclide ^{150}Ce was, by using a fast radiochemical separation technique, determined to be 4.0 ± 0.6 s. In the same way, the half-life of its daughter product ^{150}Pr was determined to be 6.2 ± 0.2 s. (auth)

11530 SPIN AND MAGNETIC MOMENT OF THE 1.094-MeV STATE IN ^{168}Er. Kim, B. T.; Chu, W. K.; Glass, J. C. (North Dakota State Univ., Fargo). Phys. Rev., C; 8: No. 5, 1920-1923 (Nov 1973).

The time-differential directional-correlation function of the 448-198-keV $\gamma-\gamma$ cascade was measured, and the half-life of the 1.094-MeV state in ^{168}Er was found to be 107.3 ± 2.2 ns. The time-differential behavior of A_{22} (t) shows a possible time-dependent interaction with a decay constant $\lambda_2 = (1.0 \pm 0.5) \times 10^7$ ns^{-1}. Extrapolation of A_{22} (t) to zero time delay gives A_{22} (0) = 0.007 ± 0.004, which is compatible with spin 4 for the 1.094-MeV state and multipolarity M1 + <8% E2 for the 448-keV transition. The g factor of the 1.094-MeV state was measured, by use of the constant-angle-differential-delay method, and found to be g = +0.45 ± 0.02. The time-dependent perturbation is interpreted in terms of rapidly fluctuating 4f electron magnetic hyperfine fields with a time-averaged value of 0.9 MG in Er^{3+} at room temperature. (3 figures) (auth)

11531 NEUTRON RESONANCE SPECTROSCOPY. XII. The Separated Isotopes of W. Camarda, H. S.; Liou, H. I.; Hacken, G.; Rahn, F.; Makofske, W.; Slagowitz, M.; Wynchank, S.; Rainwater, J. (Columbia Univ., New York). Phys. Rev., C; 8: No. 5, 1813-1826(Nov 1973).

The results of neutron resonance time-of-flight spectroscopy measurements using the Nevis synchrocyclotron are given for the separated W isotopes (182, 184, 186) and for natural W. Almost all s levels were observed to 2.65 keV, and resonance $(g)\Gamma_n^0$ values are presented to ~16 keV for the above even isotopes, and to 700 eV and 2.6 keV, respectively, for ^{183}W. The ^{183}W level assignments are from levels in natural W which were not assigned to the other isotopes. A Baye's theorem analysis shows that nearly all of the observed levels are s rather than p levels, since W is at a maximum for the s strength function S_0 but not for S_1, and the level detection sensitivity was not sufficient to detect other than exceptionally strong p levels. We were able to assign J values to 14 s levels of ^{183}W. The 41 observed ^{182}W levels to 2.65 keV and the 52 ^{183}W levels to 701 eV seem to be pure complete s populations, being fitted excellently by the Wigner nearest-neighbor-spacing theory and the Porter-Thomas reduced neutron width distribution. The orthogonal ensemble (OE) theory was found to be in good agreement with the ^{182}W and ^{183}W data. The ^{184}W level set to ~2.6 keV also seems to be an essentially complete, pure, s population sample. While it agreed within statistical limits to the above statistical theories, it gave poorer discrimination against alternate theories. Tests suggested that a few s levels in ^{184}W had been missed to ~2.6 keV. The $10^4 S_0$ values are 2.40 ± 0.31, 1.65 ± 0.32, 2.35 ± 0.24, and 2.23 ± 0.27 for 182, 183, 184, and 186, respectively. The $\langle D \rangle$ values for s populations are 66.3 ± 3.2 eV (182), 13.2 ± 0.7 eV (183), 81.3 ± 5.1 eV (184), and 90 ± 7 eV (186). A useful and accurate method for evaluating the Doppler-broadening integrals is described. (8 figures, 7 tables) (auth)

11532 GAMMA-RAY TRANSITIONS IN ^{159}Tb FOLLOWING THE (n,n') REACTION. Felsteiner, J.; Lideman, H. (Technion-Israel Inst. of Tech., Haifa). Phys. Rev., C; 8: No. 5, 1929-1933 (Nov 1973).

Energy levels of ^{159}Tb were studied from the γ-ray spectrum produced by the ^{159}Tb(n,n'γ) reaction by using a Ge(Li) detector. The spectrum shows peaks at 317, 331, 395, 440, and 520 keV which do not fit into the existing level scheme of ^{159}Tb. The possibility that the γ-ray transitions found at 912, 947, and 976 keV might belong to a $\frac{1}{2}^+$[411] rotational band is discussed. A γ ray at 248 keV is interpreted as a transition originating in the recently found 386-keV level. The weak transition from the 429-keV level to the ground state was detected. Some doublets in the γ spectrum are discussed. (4 figures, 1 table) (auth)

11533 INTERFERENCE BETWEEN DIRECT NUCLEAR REACTIONS AND COULOMB EXCITATION WITH ALPHA PARTICLES ON ^{154}Sm, ^{166}Er, AND ^{182}W. Bemis, C. E. Jr.; Stelson,

P. H.; McGowan, F. K.; Milner, W. T.; Ford, J. L. C. Jr.; Robinson, R. L.; Tuttle, W. (Oak Ridge National Lab., TN). Phys. Rev., C; 8: No. 5, 1934-1937(Nov 1973).

Striking destructive interference effects were observed in the ^{4}He excitation of the 2^+ and 4^+ ground-state-band rotational states in deformed even-A ^{154}Sm, ^{166}Er, and ^{182}W. The E2 and E4 transition moments and charge deformation parameters, β_{20}^c and β_{40}^c, are given. (2 figures, 1 table) (auth)

11534 STUDY OF NUCLEAR STATES IN ^{186}Re EXCITED BY THE (n,γ) REACTION. Glatz, J. (Technische Univ., Munich). Z. Phys.; 265: No. 4, 335-364(Nov 1973). (In German).

Prompt and delayed γ-γ-coincidences were measured after slow neutron capture in ^{185}Re by use of Ge(Li)-detectors. New isomers were found at 99.4 keV ($T_{\frac{1}{2}}$ = 27 ± 7 ns) and at approximately 330 keV ($T_{\frac{1}{2}}$ = 17.4 ± 0.7 ns). The evaluation of coincidence data established 10 rotational bands with band heads below 700 keV. The level scheme is discussed in detail: Nilsson assignments are proposed for the band configurations, and calculations of Coriolis mixing and γ-transition probabilities are presented which reproduce the experimental level energies and transition intensities very satisfactorily. (GE)

11535 CURRENT STATUS OF MEASUREMENTS OF GROUND STATE MOMENTS OF NUCLEI. Cohen, V. W. (Brookhaven National Lab., Upton, NY). J. Phys. Soc. Jap., Suppl.; 34: 63-77 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

While the spins of all stable nuclei have been determined, measurements of magnetic dipole and higher moments are being made with increasing precision with accuracy adequate to determine hyperfine anomalies. The methods of nuclear resonance in many variants, atomic beam resonance, and optical pumping are being actively pursued to determine spins and moments of short-lived nuclei. A number of recent results are given which indicate directions of current progress. (1 figure, 10 tables). (auth)

11536 E2 STATIC MOMENTS AND E2, E4 TRANSITION MOMENTS BY COULOMB EXCITATION. Diamond, R. M. (Univ. of California, Berkeley). J. Phys. Soc. Jap., Suppl.; 34: 118-134(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Coulomb excitation, when done at low enough bombarding energies so that nuclear interactions do not interfere, is a useful method for determining nuclear electric moments. With heavy ions, multiple excitation processes predominate, allowing the determination of the moments of several states; but so many levels may be involved that the calculations become quite complicated. Since a semiclassical theory is usually employed, quantal corrections must also be considered. Nevertheless, accuracy of a few percent in B(E2) values can be obtained. Static quadrupole moments for the first 2^+ state in many even-even nuclei have been measured, although some ambiguities remain. Recently, a number of E4 moments have been determined, and they appear to be quite large, $\sim 100\,B(E4)_{sp}$. (7 figures, 5 tables) (auth)

11537 INVESTIGATIONS OF QUADRUPOLE INTERACTION ON EXCITED NUCLEI RECOILING THROUGH MATTER. Herskind, B.; Bauer, R.; Gelberg, A.; Grodzins, L.; Skaali, B.; Somayajulu, D. R. S. (Univ. of Copenhagen). J. Phys. Soc. Jap., Suppl.; 34: 190-192(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11538 MEASUREMENT OF THE NUCLEAR QUADRUPOLE MOMENT OF ^{165}Ho BY PROTON AND ALPHA SCATTERING FROM AN ALIGNED TARGET. Fisher, T. R.; Parks, D. R.; Tabor, S. L.; Watson, B. A.; Triplett, B. B.; King, H. T. (Lockheed Missiles and Space Co., Palo Alto, CA). J. Phys. Soc. Jap., Suppl.; 34: 194(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11539 INVESTIGATION OF HEXADECAPOLE MOMENTS WITH COULOMB EXCITATION. Greenberg, J. S.; Shaw, A. H. (Yale Univ., New Haven). Contract AT(11-1)-3074. J. Phys. Soc. Jap., Suppl.; 34: 362-364(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Hexadecapole transition moments for the deformed rare earth nuclei ^{152}Sm, ^{154}Sm, ^{158}Gd, ^{164}Dy, ^{166}Er, ^{168}Er, and ^{174}Yb are reported. Precision measurements of M(E2;0 → 2) were also extracted from the data. Inelastic scattering of ^{4}He, ^{16}O, and ^{32}S below the Coulomb barrier was employed. (2 figures, 1 table) (RWR)

11540 ANGULAR MOMENTUM DEPENDENCE OF THE COLLECTIVE GYROMAGNETIC RATIO OF DEFORMED NUCLEI. Sano, M.; Takemasa, T.; Wakai, M. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap., Suppl.; 34: 365-369(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The Coriolis force is treated as a perturbation. Expressions for the energy gap equation using second-order perturbation theory and the collective gyromagnetic ratio, g_R, in the cranking model are written down. The formalism is applied to the nucleus ^{158}Dy. The angular momentum dependence of the energy gap parameters is exhibited, and then the moment of inertia and collective gyromagnetic ratio for ^{158}Dy are plotted. The latter decreases with an increase in the angular momentum, and reaches a minimum value at the critical angular momentum for neutrons (at which the energy gap becomes zero); g_R then increases with the rotation and reaches a value associated with the rotation of a rigid body at the critical angular momentum for protons. If the energy gap for protons is smaller than that for neutrons, the collective gyromagnetic ratio has the opposite behavior to that cited above. Finally, predicted B(E2) values based on the angular-momentum projection method are given. (3 figures, 1 table) (RWR)

11541 NON-ADIABATIC EFFECT ON THE COLLECTIVE G-FACTORS AND K-FORBIDDEN M1 TRANSITIONS IN ^{166}Er. Miyokawa, T. (Tokyo Inst. of Tech.); Katayama, I.; Morinobu, S.; Ikegami, H. J. Phys. Soc. Jap., Suppl.; 34: 370-374(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Previous work has indicated that differences may exist in g factors between different excited states, even in the same vibrational or rotational band; however, quoted experimental errors are usually so large that one can't make a final assessment of the problem. The principal aim of this work was to settle this question for the rotational levels of the ground state in ^{166}Er by making an accurate precession measurement for the 4^+ excited state. Another aim was to measure the M1 admixture in the interband transition related to the 4^+ state and to examine what kind of K impurities are responsible for the K-forbidden M1 transition. Fifteen million coincident counts were accumulated. For the 810-184 γ cascade in ^{166}Er, $A_4/A_2 = 0.349 \pm 0.015$, and the reduced spin rotation, g/Q_{00}^t, for the 4^+ state was $(5.05 \pm 0.18) \times 10^{-3}$ b^{-1}, where Q_{00} is the intrinsic quadrupole moment of the ground rotational band. Then $g_{4^+} = 0.299 \pm 0.017$. It is found that there is a possible decrease in the reduced spin rotation of about 7% for the 4^+ state with respect to the 2^+ state; such deviation is attributed to nonadiabatic effects which imply coupling between rotation, vibration, and particle motions. For the 830-280 γ cascade, $A_2/A_4 = 0.438 \pm 0.027$. The multipole mixing parameters for the 810- and 830-keV transitions were +0.061 ± 0.010 and +0.024 ± 0.011, respectively. Finally, the observed I dependence of the reduced spin rotations and the related K-forbidden M1 transitions is discussed. It was concluded that the role of the Coriolis coupling and the contribution from the K = 1 band or the core polarization are of particular importance in the magnetic properties of collective states. (5 figures, 1 table) (RWR)

11542 MAGNETIC MOMENTS OF ^{182}Re, ^{184}Re, AND ^{184m}Re MEASURED BY NUCLEAR ORIENTATION. Vanneste, L. (Louvain Univ., Belgium); Silverans, R. E.; Schoeters, E.; Huebel, H.; Guenther, C. J. Phys. Soc. Jap., Suppl.; 34: 425-426(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11543 g-FACTORS OF THE ISOMERIC STATES IN ^{174}Hf AND ^{176}Hf. Ejiri, H. (Osaka Univ., Toyonaka, Japan); Hagemann, G. B.; Hammer, T. J. Phys. Soc. Jap., Suppl.; 34: 428-429(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11544 ELECTROMAGNETIC PROPERTIES OF THE 249.7 keV LEVEL IN ^{177}Hf. Gopinathan, K. P. (Tata Inst. of Fundamental Research, Bombay); Agnihotry, A. P.; Patel, S. B.; Bidarkundi, M. S. J. Phys. Soc. Jap., Suppl.; 34: 430-431(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11545 MAGNETIC MOMENTS FOR DEFORMED NUCLEI IN A PSEUDO SU(3) MODEL. Ratna Raju, R. D.; Hecht, K. T. (Univ. of Michigan, Ann Arbor). J. Phys. Soc. Jap., Suppl.; 34: 532-534 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932.

11546 CHANGE OF NUCLEAR RADII DUE TO COLLECTIVE ROTATION. Meyer, J.; Speth, J. (Technische Univ., Munich). J. Phys. Soc. Jap., Suppl.; 34: 569-571(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The changes of nuclear charge radius $\delta\langle r_p^2\rangle$ in rotational $2_1^+ \rightarrow 0^+$ transitions arise from nonadiabatic rotational effects and contain detailed information about the intrinsic structure of rotating nuclei. The $\delta\langle r_p^2\rangle$ were calculated microscopically for even rare earth nuclei in second-order cranking theory including residual interactions in the ph and pp channels. Nilsson single-particle energies and Migdal's effective interactions were used, and the strength of the pp force was adjusted by an overall fit of the moments of inertia to E_{2^+} energies. The following conclusions were reached: The Coriolis antipairing (CAP) effect gives the dominant contribution to $\delta\langle r_p^2\rangle$ for all well-deformed nuclei, and stretching becomes important only at the lower end of the deformed region. The $\delta\langle r_p^2\rangle$ arise from the redistribution of nucleons in only a few levels in the range $|\epsilon_i - \epsilon_F| \leqq \Delta$, where ϵ_F is the Fermi energy and Δ is the gap parameter. Negative values of $\delta\langle r_p^2\rangle$ can occur when a large N = 5 level just above the Fermi energy is depopulated in favor of smaller N = 4 levels below. Since the CAP effect depends on individual levels at the Fermi surface, the changes of neutron and proton radii can differ appreciably from each other; changes of the mass distribution are not related in a simple way to changes of the charge distribution. Along with the calculation of the $\delta\langle r_p^2\rangle$, the muonic isomer shifts $\delta\langle V_\mu\rangle$ were calculated, V_μ being the muonic Coulomb potential; it was found that the ratio $\delta\langle V_\mu\rangle/\delta\langle r_p^2\rangle$ is nearly constant throughout the rare earth region. (2 figures) (RWR)

11547 CHANGE IN MEAN SQUARE RADIUS BETWEEN GROUND AND EXCITED STATES IN DEFORMED NUCLEI. Sano, M.; Wakai, M. (Osaka Univ.). J. Phys. Soc. Jap., Suppl.; 34: 581(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11548 NUCLEAR SPECTROSCOPIC QUADRUPOLE MOMENTS OF ^{175}Lu AND ^{235}U: A NEW APPROACH. Dey, W.; Ebersold, P.; Leisi, H. J.; Scheck, F.; Boehm, F.; Engfer, R.; Link, R.; Michaelsen, R. (CERN, Geneva). J. Phys. Soc. Jap., Suppl.; 34: 582-583(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11549 SEARCH FOR STRONG INTERACTION QUADRUPOLE EFFECT IN THE PIONIC ATOM OF ^{175}Lu. Dey, W.; Ebersold, P.; Leisi, H. J.; Scheck, F.; Boehm, F.; Engfer, R.; Link, R.; Michaelsen, R. (CERN, Geneva). J. Phys. Soc. Jap., Suppl.; 34: 584-585(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11550 HIGH MOMENTUM STATES OF DEFORMED NUCLEI IN THE COLLECTIVE MODEL. Budnik, A. P.; Seregin, A. A. Yadern. Fiz.; 19: No. 5, 979-986(May 1974). (In Russian).

The method of numerical calculation of the Schrödinger equation is presented for the collective nuclear model. This method is used to calculate the positions of the levels of the lower band for the spins $J \leq 20$, the potential energy depending on the variables β and $\cos 3\gamma$. The results are compared with the experimental data. (auth)

11551 MEAN FISSION NEUTRON CROSS-SECTION FOR THE REACTION ^{181}Ta(n,p)^{181}Hf. de Regge, P.; Dams, R.; Hoste, J. (Ghent State Univ.). Radiochim. Acta; 19: No. 3, 102-106(1973).

The cross section for the reaction ^{181}Ta(n,p)^{181}Hf averaged over the fission neutron spectrum was determined experimentally from the ^{181}Hf activity induced in irradiated Ta_2O_5. The Ta_2O_5 target was purified by liquid-liquid extraction with methylisobutylcetone from a H_2SO_4-HF solution. The induced ^{181}Hf activity was separated and purified using anion exchange in hydrochloric-oxalic acid medium. The ^{181}Hf activity was measured by fast-slow coincidence spectrometry. A value of 1.2 ± 0.3 μbarn was obtained for the cross section. (orig.) (GE)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 10972, 11381, 11403, 11421, 11445, 11470, 11507, 11508, 11519, 11524, 11537, 11579, 11589, 11614, and 11637.

11552 (PTUM-E-18-2) MEASUREMENT OF HIGH-ENERGY CONVERSION ELECTRONS OF ^{200}Hg AND ^{158}Gd. Mampe, W. (Technische Univ. Muenchen (F. R. Germany). Fakultaet fuer Allgemeine Wissenschaften). 18 May 1971. 47p. (In German). INIS.

Following a description of the characteristics of a magnetic beta spectrometer designed for the measurement of conversion electrons, the author reports the results of measuring experiments on high-energy conversion electrons of ^{200}Hg and ^{158}Gd. (20 figures, 8 tables, 70 references) (GE)

11553 NUCLEAR MAGNETIC MOMENT OF ^{207}Bi AND REORIENTATION IN THE 0.8-SEC ISOMER OF ^{207}Pb. Johnston, P. D. (Clarendon Laboratory, University of Oxford, Oxford, England and Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213); Kaplan, M.; Stone, N. J. Phys. Rev. Lett. 32: No. 14, 784-787 (8 Apr 1974).

The ground-state nuclear magnetic moment of ^{207}Bi has been measured by nuclear orientation in the hyperfine field of a nickel host. The unperturbed anisotropy of the 1770-keV γ ray gives the results $\mu = (4.63 \pm 0.25)$ μ_N and $[\delta\ (E2/M1)]_{1770} = -0.0836 \pm 0.0030$. Strongly attenuated anisotropies are observed for γ-ray transitions which pass through the 0.8-sec isomer in ^{207}Pb, and these are quantitatively explained in terms of a perturbing quadrupole interaction in this state. (auth)

11554 THICK-ABSORBER LINE-SHAPE ANALYSIS AND INTERFERENCE EFFECTS IN MOESSBAUER ABSORPTION SPECTRA FOR THE E2/M1 77.3-keV TRANSITION OF ^{197}Au. Erickson, D. J. (Univ. of North Carolina, Chapel Hill); Prince, J. F.; Roberts, L. D. Phys. Rev., C; 8: No. 5, 1916-1919(Nov 1973).

A dispersion term which is attributed to interference between internal conversion following nuclear resonance absorption of γ rays and the photoelectric effect was observed in ^{197}Au Moessbauer absorption spectra measured as a function of Au-metal-absorber thickness. From line-shape analysis which accounts for absorber thickness, the amplitude of the dispersion term is found to be $\zeta = (-4.14 \pm 0.17) \times 10^{-3}$. Neglect of the dispersion term leads to an apparent thickness-dependent isomer shift, whereas inclusion of the dispersion term gives isomer shifts properly independent of thickness. (3 figures, 1 table) (auth)

11555 INTERFERENCE BETWEEN COULOMB AND NUCLEAR EXCITATION IN THE INELASTIC SCATTERING OF ^{11}B IONS FROM ^{208}Pb. Ford, J. L. C. Jr. (Oak Ridge National Lab., TN); Toth, K. S.; Hensley, D. C.; Gaedke, R. M.; Riley, P. J.; Thornton, S. T. Phys. Rev., C; 8: No. 5, 1912-1915(Nov 1973).

The elastic and inelastic scattering of 72.2-MeV ^{11}B ions from ^{208}Pb were studied. The angular distributions for transitions to the 3^-, 5^-, 2^+, and 4^+ states at 2.61, 3.20, 4.10, and 4.31 MeV, respectively, show pronounced effects due to interference between Coulomb and nuclear excitation. The data are well reproduced by distorted-wave calculations, provided that the phase of the nuclear excitation form factor is altered by 5° from that given by the collective model. (3 figures, 1 table) (auth)

11556 $\beta-\gamma$ DIRECTIONAL CORRELATION OF ^{203}Hg. Wyrick, J. M.; Weber, A. H. (Saint Louis Univ., St. Louis). Phys. Rev., C; 8: No. 5, 1955-1956(Nov 1973).

The $\beta-\gamma$ directional correlation of the first-forbidden β transition of ^{203}Hg was investigated. The energy dependence of the $\beta-\gamma$ directional-correlation coefficient A_{22} in the directional-correlation function $W(\theta) = 1 + A_{22}P_2(\cos\theta)$ was measured as a function of β energy $\overline{W}$. Experimental values obtained for the $\beta-\gamma$ directional-correlation coefficient were $A_{22}(\overline{W}) = -0.0069 \pm 0.0010$ ($\overline{W} = 1.157$); -0.0083 ± 0.0010 ($\overline{W} = 1.196$); -0.0100 ± 0.0010 ($\overline{W} = 1.254$); -0.0118 ± 0.0010 ($\overline{W} = 1.313$). (1 figure, 1 table) (auth)

11557 EXPERIMENTAL DETERMINATION OF SOME MATRIX ELEMENTS OF THE EFFECTIVE RESIDUAL INTERACTION AMONG PARTICLE-HOLE CONFIGURATIONS IN ^{208}Pb. Heusler, A. (CEN de Saclay, Gif-sur-Yvette, France); von Bretano, P. Ann. Phys. (N. Y.); 75: No. 2, 381-404(Feb 1973).

Matrix elements of the residual interaction in ^{208}Pb are derived from the wave functions and the energies of states and configurations in ^{209}Pb. From the experimentally determined wave functions of 20 low-lying states in ^{209}Pb with spins $I^\pi = 2^-$, 3^-, 4^-, 5^-, 6^-, 7^- one obtains matrix elements of the effective residual interaction among particle-hole configurations defined with respect to the physical ground state of ^{208}Pb. The average value of these matrix elements is about 100 keV. No significant difference in the average value of the off-diagonal matrix elements is found for the different spin values. Also many nondiagonal matrix elements have values approaching the diagonal matrix elements. (auth)

11558 EFFECTIVE MAGNETIC DIPOLE OPERATORS AND THE LIFETIME OF THE $3/2^-$ STATE IN ^{207}Pb. Dost, M.; Rogers, J. D. (Rutgers-The State Univ., New Brunswick, NJ). Rev. Brasil. Fis.; 3: No. 2, 217-238(Oct 1973).

A lifetime of $\tau = (0.15 \pm 0.03)$ psec for the 897 keV $3/2^-$ state in ^{207}Pb is determined by the Doppler shift attenuation method in thick target Coulomb excitation by 68 and 61 MeV ^{32}O ions on ^{207}Pb. The analysis uses the Monte Carlo method to treat the slowing down of the recoiling Pb nuclei in Pb, and takes into account the effects of particle-γ angular correlations, finite detector size, and the slowing down of the projectiles in the target. The derived value of B(M1, $3/2^- \rightarrow 1/2^-$) = $(0.52 \pm 1.10)(eh/2mc)^2$ can not be described with the same effective magnetic moment operator as describes the magnetic dipole moments in nuclei around ^{208}Pb. (auth)

11559 PROMISE AND SIGNIFICANCE OF MEASUREMENTS OF MOMENTS OF SHORT-LIVED NUCLEAR STATES. Grodzins, L. (Univ. of Copenhagen). J. Phys. Soc. Jap., Suppl.; 34: 30-46 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Almost no magnetic or quadrupole moments are known for subnanosecond nuclear states with spins greater than 4. Recently developed techniques together with beams of heavy ions from accelerators just coming into operation will open up this important area to practical investigation. The established techniques are reviewed. Phenomena which may be useful for these measurements in the future are speculated upon; in particular, the possibility of magnetic fields from polarized atoms and of quadrupole precessions produced by various interactions is considered. (10 figures, 1 table) (auth)

11560 NUCLEAR STRUCTURE STUDIES WITH POLARIZED ^{207}Bi, ^{210}Bi(RaE) AND POLARIZED ^{209}Bi TARGETS. Nagamine, K.; Koyama, H.; Nishida, N.; Takizawa, M.; Nakai, K.; Yamazaki, T. (Tokyo Univ.). J. Phys. Soc. Jap., Suppl.; 34: 113-117(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Studies of polarized radioactive Bi isotopes were performed at low temperature in a ferromagnetic BiMn compound where Bi nuclei were found to feel a large hyperfine field around 1 MG. An application of the polarized ^{209}Bi target to the study of magnetic hfs in muonic atom is discussed. (3 figures) (auth)

11561 EFFECTIVE E2 CHARGES IN THE Pb REGION. Blomqvist, J. (Research Inst. for Physics, Stockholm). J. Phys. Soc. Jap., Suppl.; 34: 223-229(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The experimental information on effective E2 charges in the Pb region is summarized. e_{eff} is found to be the same in configurations with one, two, and three $h_{9/2}$ protons added to ^{208}Pb. The variation of e_{eff} when a neutron occupies different orbitals is well described by coupling the particle to the oscillating core. The magnitudes of the isoscalar and isovector polarization charges agree with theoretical predictions. (auth)

11562 SUMMARY OF MAGNETIC MOMENTS OF HIGH-SPIN STATES IN THE Pb REGION. Nagamiya, S. (Tokyo Univ.). J. Phys. Soc. Jap., Suppl.; 34: 230-238(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The g factors of several shell-model states in the Pb region are summarized from the viewpoint of the nuclear shell model. Almost all the g factors of many-particle states in this region satisfy the shell-model additivity relation of the g factor. Empirical values of δg_s and g_p are compared with the calculated values. Blocking effect of the $(\pi h_{9/2}^{-1} \pi h_{9/2})$—type core polarization on the g factors of the $\pi h_{9/2}^n$ states has been observed in the experimental data, in agreement with the theoretical expectation. Finally the g factors of the several states, which involve the $(\pi h_{9/2}^2)_{8^+}$ and $\nu i_{13/2}^n$ configurations, are discussed. (6 figures, 2 tables)

11563 $g(\pi h_{9/2}^2, J)$ DIFFERENCE FOR 6_1^+ AND 8_1^+ STATES IN ^{210}Po. Baba, C. V. K.; Fossan, D. B.; Faestermann, T.; Feilitzsch, F.; Kienle, P.; Signorini, C. (Univ., Munich, Garching, Ger.). J. Phys. Soc. Jap., Suppl.; 34: 239-242(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

For pure single-particle states and j−j coupling the magnetic moments of several nucleons add as their angular momenta; i.e., $g(j^n, J) = g(j^n, J')$. An experiment was done to check the equation in the ^{210}Po nucleus. The classic DPAC experiment used to measure the difference in g factors is described. The measurement was performed at 24 MeV with the ^{208}Pb$(\alpha, 2n)$ reaction. It was found that $(g_6 - g_8)/g_8 = +(2.0 \pm 0.7)\%$; this result leads to a value of $g_8 = 0.93 \pm 0.02$. (1 figure) (RWR)

11564 MAGNETIC MOMENTS OF THE 12^- STATES IN ^{196,198,200}Au. Bacon, F.; Kaindl, G.; Mahnke, H. E.; Shirley, D. A. (Univ. of California, Berkeley). J. Phys. Soc. Jap., Suppl.; 34: 243-244(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Low-temperature nuclear orientation experiments were used to obtain the magnetic moments of three spin-12 gold isomers. The ^{200m}Au moment is consistent with anomalous orbital magnetism. (1 table) (auth)

11565 g FACTOR OF THE 7^+ ISOMERIC STATE IN ^{202}Tl. Hashimoto, O. (Tokyo Univ.); Sumi, A.; Nomura, T.; Nagamiya, S.; Nakai, K.; Yamazaki, T.; Miyano, K. J. Phys. Soc. Jap., Suppl.; 34: 269-270(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11566 MAGNETIC MOMENTS OF THE FIRST EXCITED STATES OF ^{207}Pb AND ^{208}Pb. Schroeder, F. J.; Toschinski, H. (Univ., Bonn). J. Phys. Soc. Jap., Suppl.; 34: 271-273(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11567 M1 TRANSITIONS IN ^{203}Bi. Olin, A.; Haeusser, O.; Ward, D.; Disdier, D. L. (Atomic Energy of Canada Ltd., Chalk River, Ont.). J. Phys. Soc. Jap., Suppl.; 34: 275-277(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11568 SINGLE PARTICLE TRANSITIONS NEAR ^{208}Pb. Khanna, F. C.; Haeusser, O.; Ward, D. (Atomic Energy of Canada Ltd., Chalk River, Ont.). J. Phys. Soc. Jap., Suppl.; 34: 278-280 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11569 DETERMINATION OF NUCLEAR SPINS, MOMENTS AND CHARGE VOLUMES FAR FROM STABILITY BY OPTICAL PUMPING. Bonn, J.; Huber, G.; Kluge, H. J.; Koepf, U.; Kugler, L.; Otten, E. W.; Rodriguez, J. (CERN, Geneva). J. Phys. Soc. Jap., Suppl.; 34: 317-323(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The 600-MeV synchrocyclotron at CERN and ISOLDE were used to obtain Hg isotopes from the Pb(p,3pxn) reaction. The experimental procedure employing an optical pumping apparatus is described; the information obtainable in this way leads to an unambiguous determination of I, μ_I, Q, and the isotope shift (IS). Results are tabulated for various isotopes ranging from A = 183 to A = 205. The value for the IS and the deviation of the lightest Hg isotopes from the established trend are discussed. (6 figures, 1 table) (RWR)

11570 ELECTROMAGNETIC PROPERTIES OF 2^+ AND $2^{+\prime}$ STATES OF ^{192,194,196}Pt. Rougny, R.; Meyer-Levy, M.; Berkes, I.; Lhersonneau, G.; Troncy, A. (Univ., Lyon). J. Phys. Soc. Jap., Suppl.; 34: 375-376(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Lifetimes were determined by delayed coincidences between Ce and γ or x rays. The lifetimes were calculated by comparison of centroid shifts corresponding to selected cascades. The lifetimes for the 2^+ and $2^{+\prime}$ states were as follows: ^{194}Pt: 50 ± 5 ps and 51 ± 6 ps; ^{196}Pt: 43.6 ± 3.0 ps and 52 ± 5 ps. Branching ratios and B(M1) and B(E2) values were deduced. Nuclear g factors were determined by integral spin-rotation measurements performed in the hyperfine field in an Fe alloy. The ratios $B(E2;2' \rightarrow 2)/B(E2;2 \rightarrow 0)$ and $B(E2;2' \rightarrow 0)/B(E2;2 \rightarrow 0)$ show a diminishing trend as a function of atomic mass. The experimental results are compared with theoretical predictions. (1 table) (RWR)

11571 COULOMB EXCITATION OF ^{208}Pb WITH HEAVY IONS. Barnett, A. R.; Biagi, S. F.; Olsen, D. K.; Phillips, W. R. (Univ. of Manchester, Eng.). J. Phys. Soc. Jap., Suppl.; 34: 389-392(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The static quadrupole moment of the 2.6-MeV 3^- state of ^{208}Pb is being remeasured by a γ-ray method. So far beams of ^{12}C, ^{20}Ne, ^{32}S, and ^{40}Ar have been used, with the result $Q(3_1^-) = -0.9 \pm 0.4$ b. This value depends weakly on $Q(2_1^+, ^{206}Pb)$, and it agrees with the earlier determination of -1.3 ± 0.6 b. It also agrees with the finite-Fermi-system calculation of Krainov. (5 figures) (auth)

11572 M1 CORE POLARIZABILITIES OF THE 8^+ AND 6^+ STATES IN ^{210}Po. Tonozuka, I. (Tokyo Univ.); Sasaki, K.; Harada, K. J. Phys. Soc. Jap., Suppl.; 34: 475-478(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

M1 core polarizabilities of the low-lying excited states of ^{210}Po were studied on the basis of the first-order perturbed calculation in the framework of the shell model. It was shown that the M1 core polarization of the type of $(h_{9/2}, h_{9/2}^{-1})1^+$ in ^{210}Po is more blocked than in ^{209}Bi, and that this blocking effect has a large J dependence. (3 figures, 2 tables) (auth)

11573 EFFECTIVE CHARGES AND G-FACTORS WITH A DENSITY DEPENDENT RESIDUAL INTERACTION. Speth, J. (Technical Univ., Munich). J. Phys. Soc. Jap., Suppl.; 34: 479-487(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Recent calculations of electric and magnetic moments and transition probabilities of odd- as well as of even-mass nuclei with a density-dependent residual interaction are reported. All theoretical results except the l-forbidden M1 transitions are in good agreement with the experimental values. (3 figures, 9 tables) (auth)

11574 MAGNETIC MOMENTS OF SHELL-MODEL STATES IN THE LEAD REGION. Nagamiya, S. (Tokyo Univ.). J. Phys. Soc. Jap., Suppl.; 34: 623-628(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11575 ANALOG RESONANCES: SOME ASPECTS OF REACTION MECHANISM AND SPECTROSCOPY REVISITED. Wurm, J. P. (Max-Planck-Institute fuer Kernphysik, Heidelberg). pp 86-104 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

Several different topics are discussed. Line broadening occurs if an isolated isobaric analog resonance (IAR) is allowed to interact with a series of equal-spaced levels. The most obvious effect of the broadening is described by the spreading width. The broadening has two consequences: the energy-averaged S matrix is not unitary, and the compound-nucleus absorption is large on resonance and displays a Lorentzian or more complicated, asymmetric resonance shape. The measurement of the polarization of inelastically scattered protons could be a sensitive test for channel-channel correlations, and an experiment along these lines is described. Many open neutron channels and large B(Eλ) values for direct excitation tend to produce a large direct background. IAR may then provide an example of "enhancement" of the direct scattering; disregard of this may be hazardous for spectroscopy. A good candidate for this, the octupole excitation of ^{208}Pb, is discussed. Numerical calculations of enhancement have not yet been done, but the method involved is outlined. A case of intermediate structure not related to isospin conservation in ^{40}Ca + p is described. (11 figures) (RWR)

11576 TOTAL CROSS SECTION OF ^{207}Pb FOR NEUTRONS NEAR 17 MeV. Anderson, J. D.; Barschall, H. H.; Davis, J. C. (Univ. of California, Livermore). Yadern. Fiz.; 19: No. 5, 943-944(May 1974). (In Russian).

A resonance in the total cross section of ^{207}Pb has recently been reported at a neutron energy of 16.8 MeV. This resonance was not found in the present measurement. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 11347, 11437, 11445, 11468, 11519, 11528, 11536, 11545, 11548, 11622, and 11996.

11577 (AAEC/E-304) INVESTIGATION OF THE ENERGETICS OF BINARY AND TERNARY FISSION IN ^{252}Cf AND ^{236}U. Musgrove, A. R. de L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

An attempt is made to calculate the total energy released in binary, neutron accompanied and α-particle accompanied fission of ^{236}U* and ^{252}Cf. Using measured values for the average kinetic energy released in fission, estimates are obtained for the average deformation-excitation energy of fission in each mode. The average number of neutrons emitted from the accelerated fragments in each fission mode is also evaluated and leads to estimates for the average energy required to emit a neutron in binary and ternary fission. Best values are found for the differential energetics between binary and ternary fission in ^{252}Cf and ^{236}U*. By comparing their electrostatic potential energies at the moment of scission, the mean extension of positive charge is found to be greater on average in α-particle accompanied fission, than in binary fission. A number of experimentally determined parameters of interest in fission theory are also presented. (auth)

11578 (CEA-N-1646) SEMI-ANNUAL BULLETIN NO.3, JANUARY-JUNE 1973. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). 1973. 151p. (In French). Dep. NTIS (US Sales Only) $10.75.

The following fields of study are considered: nuclear physics (fission, distribution of fission products, light nuclei, and the electric dipole moment of the neutron); the physical effects of radiations on solids; magnetic properties of transition element compounds and alloys, rare earth elements and actinides; structure and properties of transition element compounds, alloys and complexes, semiconductors and insulators; stable free radicals (nitroxides); stereochemistry; photochemistry; proton dynamics of the hydrogen bond; protein and biological membrane structures and functions; radiobiology; nucleic acid structure and functions. An ion beam sputtering system was studied in the area of applied research. (FR)

11579 (CONF-740419-1) SURVEY OF eV AND keV NEUTRON REACTIONS. Harvey, J. A. (Oak Ridge National Lab., Tenn. (USA)). 1974. 39p. Dep. NTIS $5.00.

From 2nd international school on neutron physics; Alushta, USSR (2 Apr 1974).

The survey begins with a review of the compound-nucleus model and the information obtainable with neutron reactions, distributions of resonance parameters, average properties of resonance parameters, nonstatistical effects, intermediate structure, and doorway states. Experimental techniques, measurements and analysis are then taken up, with emphasis on facilities at the Oak Ridge Electron Linear Accelerator (ORELA); the time-of-flight technique, detector systems at ORELA, analysis of total, capture, and fission data, statistical tests for intermediate structure, and averaged resonance capture and beams of filtered neutrons are included. Results from total cross section measurements are then presented. The total cross section of Ca from neutron potential scattering is shown from 50 to 1050 keV. Measurements of the total cross section of ^{207}Pb near 180 and 320 keV demonstrated the nonexistence of a giant M1 resonance in ^{208}Pb. The total cross section of ^{208}Pb, of interest because it is perhaps the best example of a doorway state and because a giant M1 resonance has been reported in ^{207}Pb, is given from 190 to 430 keV; it shows that earlier attempts to establish a correlation between the ground-state widths and neutron widths for s-wave resonances were meaningless. E1 valency transitions from ^{91}Zr(γ,n$_0$) and ^{90}Zr(σ_T) data are also discussed. Attention is then directed to subthreshold and threshold fission. The double-humped potential for subthreshold fission and coupling between class-I and class-II states are considered, and data are presented on the subthreshold and threshold fission and total cross section of ^{234}U; subthreshold fission in ^{240}Pu and ^{238}U is also examined. Polarized-neutron polarized-target fission of ^{237}Np and ^{235}U and spin determinations are then described. In conclusion, information on neutron capture reactions related to the question of doorway states and nonstatistical effects is given. (14 figures, 54 references) (RWR)

11580 (CONF-740526-1) RECENT U. S. EXPERIMENTAL DATA AND EVALUATION FOR ^{239}Pu. de Saussure, G. (Oak Ridge National Lab., Tenn. (USA)). 1974. 16p. Dep. NTIS $4.00.

From specialists meeting on resonance parameters of fertile nuclei (232Th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

Neutron capture and fission cross sections evaluations for plutonium-239 are summarized. (JFP)

11581 (CONF-740526-2) RECENT MEASUREMENTS ON U-238 AT ORNL. de Saussure, G. (Oak Ridge National Lab., Tenn. (USA)). 1974. 16p. Dep. NTIS $4.00.

From specialists meeting on resonance parameters of fertile nuclei (232th, 238U, 240Pu) and of 239Pu; Saclay, France (20 May 1974).

An attempt is made to resolve discrepancies in previous measurements of the capture cross section of uranium-238 at 5 eV to 100 keV by means of a new series of experiments with a detector entirely different from that used previously. (JFP)

11582 (COO-3058-50) LINEAR ACCELERATOR PROJECT. Progress Report, January 1, 1974-March 31, 1974. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA)). 1974. Contract AT(11-1)-3058. 10p. Dep. NTIS $4.00.

This quarterly report describes neutron cross section measurements on ^{242}Pu, ^{54,58}Fe, ^{61}Ni, ^{105}Pd, ^{151}Eu, and ^{153}Eu, along with activities in the area of reactor theory and analysis. (4 figures, 1 table) (RWR)

11583 (INIS-mf-1297) ELECTRON CAPTURE DECAY OF NEUTRON DEFICIENT AMERICIUM ISOTOPES. Post, J. C. (Amsterdam Univ. (Netherlands)). 12 Apr 1972. 96p. INIS.

The first extensive research on neutron deficient americium isotopes was made by Glass before 1960 with NaI(Tl) crystal detectors. In 1970 ^{237}Am and ^{240}Am are investigated with Ge(Li) detectors. The results are given of the investigations on the production, chemical separation and precipitation and the gamma spectroscopic properties of these isotopes, as they are measured with Ge(Li) detectors. Finally some possible conclusions are discussed regarding the electron capture decay of these isotopes. The americium isotopes are obtained by irradiation of ^{237}Np with ^{4}He ions. The chemical separation of the matrix material and the fission products is carried out by selective absorption in an anion-exchange column and a silicagel column, and by hydroxide precipitation as well as coprecipitation with lanthanum trifluoride. After oxidation pentavalent americium is separated by the absorption of all of the trivalent lanthanides in a teflon column loaded with a HDEHP solution. Next cerium is separated as cerium tetraperiodate, and tellurium and rhodium as the metal. A very pure product is obtained and measured with different Ge(Li) detectors. The results are fairly equal to those already published. The results for ^{238}Am and ^{239}Am are as far as possible in accordance with those obtained from beta decay of ^{238}Np and ^{239}Np. In the case of ^{238}Am fourteen more gamma transitions are observed. Ten of these deexcite five high levels (above 1 MeV). However, serious objections can be put forward against the existence of the highest level. (auth)

11584 (KAPL-M-7323) REICH AND MOORE MULTILEVEL ANALYSIS OF ^{233}U NEUTRON CROSS SECTIONS. Reynolds, J. T.; Stieglitz, R. G. (Knolls Atomic Power Lab., Schenectady, N. Y. (USA)). 29 Jun 1973. Contract W-31-109-eng-52. 66p. Dep. NTIS $6.50.

The Reich and Moore multilevel formalism was used to evaluate the neutron cross sections for ^{233}U between 0 and 60 eV. The authors believe that the Reich and Moore formalism is the best available for analyzing data for fissile nuclei, and present the basis for this conclusion. The evaluated cross sections are as reliable as possible with the presently available data, and improvements would require additional data. The most important difference between this evaluation and ENDF/B is due to a background correction made to the (n,γ) data in the present work. (32 figures, 7 tables) (auth)

11585 (KFK-1917) CALCULATION OF ^{237}Np AND ^{241}Am ABSORPTION RATES IN REACTOR IRRADIATIONS. Klunker, J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Feb 1974. 32p. (In German). Dep. NTIS (US Sales Only) $4.75.

To calculate the yield of ^{238}Pu from ^{237}Np or ^{241}Am reactor irradiations, neutron spectrum and self-shielding effects have to be taken into account. In this report equations, tables, and diagrams are given which allow easy determination of the absorption rates of rods and 3-rod bundles provided that the ratio $\frac{\Phi_{epi}}{\Phi_{th}}$ of the reactor is known. The results are based on numerical calculations of the effective resonance integrals of ^{237}Np and ^{241}Am with special emphasis on the lower cutoff energy. The calculated resonance integrals agree satisfactorily with measurements. (8 figures, 6 tables) (auth)

11586 (KFK-1950) REPORT ON RESEARCH AND DEVELOPMENT FOR THE YEAR 1973. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F.R. Germany)). Feb 1974. 316p. (In German). Dep. NTIS (US Sales Only) $19.00.

An overview of the various research and development activities is given through a number of brief reports. The scope of the document can perhaps best be given by listing the different sections contributing to it: Institute for applied nuclear physics, Institute for applied technical systems and reactor physics, Institute for experimental nuclear physics, Institute for neutron physics and reactor science, Institute for nuclear-process science, Institute for materials and solid state research, Institute for reactor fuel elements, Institute for reactor development, Institute for hot-atom chemistry, Institute for radiochemistry, Institute for radiation biology, Institute for data processing, School of nuclear science, Division of reactor operation and technology, Cyclotron particle accelerator, Division for data processing and instrumentation, Division of radiation protection and safety, Division of decontamination, Laboratory for isotope technology, and Medical division. (RWR)

11587 (NIIAR-P-181) MEASURING SOME CHARACTERISTICS OF BERKELIUM-249 AND COMPARISON OF COUNTING METHODS. Glazov, V. M.; Borisova, R. I.; Shafiev, A. I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Melekess (USSR)). 1973. 18p. (In Russian). INIS.

A sample of berkelium-249 was obtained after separation and purification by multiple absorption on zirconium phosphate and a Dowex-1 anion exchanger. The limiting beta energy determined was found to be 123 ± 3 keV, from a Kurie plot and 124 ± 3 keV by an absorption method. By measurements over a period of one year the half-life was found to be 325 ± 7 days. A comparison was carried out of beta counting efficiencies for berkelium-249 on gas-flow 4π, gas end-window, and scintillation counters with a liquid scintillator, a stilbene crystal, anthracene, and semiconductor detectors. (4 figures, 6 tables) (tr-auth)

11588 (NIIAR-P-200) NEUTRON RESONANCE ABSORPTION IN HOMOGENEOUS MEDIA. Platonov, A. P. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1973. 28p. (In Russian). INIS.

A comparison is given for the effective resonance capture integrals of ^{238}U, determined both by exact and by approximate methods. Consideration is given to resonance absorption on ^{238}U nuclei for the 170 to 220 eV energy interval, which contains two scattering resonances with relatively large widths and a noticeable interference structure in the cross sections. On the basis of exact values of the resonance integral, parameters were determined for calculations of effective integrals in the GR approximation, described in the study, and a comparison was carried out with approximate values. The results of the calculations show that numerical methods are necessary in analyzing resonance absorption on "intermediate" levels of ^{238}U. (5 figures, 3 tables) (tr-auth)

11589 (UCRL-50400(Vol.7)(Pt.B)) GRAPHICAL EXPERIMENTAL DATA FOR MAJOR NEUTRON-INDUCED INTERACTIONS (Z > 55). Cullen, D. E.; Haight, R. C.; Howerton, R. J.; MacGregor, M. H.; Perkins, S. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Apr 1974. Contract W-7405-eng-48. 600p. Dep. NTIS $13.60.

The total, elastic, capture, and fission cross sections contained in the Experimental Cross Section Information Library (ECSIL) as of March 1, 1974 are presented in graphical form. For the sake of clarity, these data are plotted without associated error bars. The plots are arranged in ascending order of atomic number (Z) and atomic weight (A). Part A contains the plots for Z = 1 to 55, and Part B contains the plots for Z > 55. (auth)

11590 POTENTIAL-ENERGY SURFACE FOR THE FISSION OF THE SUPERHEAVY NUCLEUS $^{292}_{114}X_{184}$. Mustafa, M. G.; Schmitt, H. W. (Oak Ridge National Lab., TN). Phys. Rev., C; 8: No. 5, 1924-1928(Nov 1973).

The asymmetric two-center model was used to calculate the potential-energy surface of the superheavy nucleus $^{292}_{114}X_{184}$. Four shape variables, including two for asymmetric degrees of freedom, were used to describe the nuclear shape. The minimum-potential-energy path for fission follows reflection-symmetric shapes from the ground state to beyond the second barrier; in this region the surface becomes soft, and a variety of paths becomes available. For lesser elongations, asymmetric shapes are briefly preferred; for greater elongations, symmetric shapes are preferred. The paths converge in the main, steeply descending scission valley, for which the liquid-drop term dominates and reflection-symmetric shapes are slight preferred. (3 figures, 2 tables) (auth)

11591 (n,2n) CROSS SECTIONS FOR ^{238}U AND ^{237}Np IN THE REGION OF 14 MeV. Landrum, J. H.; Nagle, R. J.; Lindner, M. (Univ. of California, Livermore). Phys. Rev., C; 8: No. 5, 1938-1944(Nov 1973).

The cross sections for formation of ^{237}U from ^{238}U and for the eventual formation of ^{236}Pu from ^{237}Np by the (n,2n) reaction were measured relative to the ^{27}Al(n,α)^{24}Na cross section. Neutrons were produced by the irradiation of titanium tritide targets with 400-keV deuterons on the Livermore insulated core transformer (ICT) neutron generator. The determinations covered the neutron energy range from 13.7 to 14.9 MeV. From the partial cross section for ^{236}Pu formation, the cross section was calculated for the ^{237}Np total (n,2n) reaction, including the branch leading to ^{236m}Np. (5 figures, 4 tables) (auth)

11592 EFFECT OF NUCLEONIC STRUCTURE OF FISSIONABLE NUCLEI ON THE MEAN KINETIC ENERGY OF FRAGMENTS. Vorob'eva, V. G.; D'yachenko, N. P.; Kolosov, N. P.; Kuzminov, B. D.; Sergachev, A. I. Yadern. Fiz.; 19: No. 5, 954-958(May 1974). (In Russian).

The mean kinetic energy of fragments from the fission of uranium and plutonium isotopes are measured relatively to the general unit, i.e., the mean kinetic energy of fragments from thermal fission of ^{235}U. The results are discussed under the assumption of Coulomb nature of the kinetic energy of fragments. There are also given the results of measuring the dependence of the mean kinetic energy of fragments for ^{238}U, ^{241,242}Pu upon the energy of

neutrons inducing the fission. The difference of those dependences for U and Pu isotopes is underlined. (auth)

Nuclear Theory

Refer also to abstracts 9662, 11048, 11210, 11256, 11260, 11269, 11391, 11411, 11429, 11450, 11455, 11495, 11649, and 11711.

11593 (FEI-367) CORRELATION OF ENERGY DEPENDENCIES AND OF MEAN KINETIC ENERGY OF FISSION FRAGMENTS. Vorob'eva, V. G.; D'yachenko, P. P.; Kuz'minov, B. D.; Sergachev, A. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 19p. (In Russian). INIS.

This study presents the results of analyzing the fission energy balance with the use of experimental data from measurements of $\bar{\nu}$, the yields and kinetic energies of fission product nuclei. It is concluded that it is possible to determine deviations of the energy dependence of $\bar{\nu}$ from a straight line on the basis of experiments on measurements of the yields and kinetic energies of fission products. (SJR)

11594 (HU-TFT-73-2) EFFECTIVE THREE-BODY PROBLEMS IN NUCLEAR REACTIONS. Bencze, G. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1973. 42p. INIS.

The formal properties of effective three-body problems occurring in many-particle scattering processes are investigated in an exact three-body formalism. The three-body treatment is related to conventional nuclear reaction theory, and also some aspects of introducing three-body models for direct reactions are discussed. (auth)

11595 (IAEA-153, pp 189-201) INTERPRETATION OF TRENDS IN TOTAL NEUTRON CROSS SECTIONS. Angeli, I.; Csikai, J. (Kossuth Lajos Tudcmanyegyetem, Debrecen, Hungary). 1973.

From proceedings of a panel on neutron nuclear data evaluation; Vienna (30 August-3 September 1971).

For medium and heavy nuclei, it is shown that the smooth dependence of the total neutron cross sections on mass number can be explained by a simple semi-classical picture, the so-called "nuclear Ramsauer effect" with reasonable values of the real optical potential depth and surface thickness. At 14 MeV neutron energy data seem to suggest a strong surface absorption. Extending the investigation to different energies, it was found that the above picture can be applied to the interpretation of the total cross sections for $E > 10$ MeV only, though a simple formula of practical interest holds also for lower energies. Some refinement can be attained using a corrected form of the blanck nucleus formula. For light nuclei, a correlation between the nuclear radius parameter r_0, and the average binding energy per nucleon E/A, was found. Results of Hartree-Fock calculations for light nuclei also show this correlation. (auth)

11596 (IFA-CRD-56-1974) SUBPROGRAMS FOR THE CALCULATION OF THE CLEBSCH-GORDON, RACAH, AND FANO COEFFICIENTS USING THE PDP-8/I COMPUTER. Duma, M.; Teodorescu, C. M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 15p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

The computation of the Clebsch-Gordan, Racah, and Fano angular momentum coupling coefficients, performed with the subroutines written in the FOCAL 8 K programming language for PDP-8/I computer, is discussed. (3 tables) (auth)

11597 (INIS-mf-1320, pp 1-66, Pt. 7) VARIATIONAL AND SELF-CONSISTENT FIELD THEORIES OF NUCLEAR COLLECTIVE NOTION. Rowe, D. J. (Univ. of Toronto). 1972.

The variational and self-consistent field definitions of single-particle states for closed-shell and for open-shell nuclei are discussed. (auth)

11598 (JINR-E4-7764) APPROXIMATE SOLUTION OF THE EQUATIONS OF THE MODEL FOR THE DESCRIPTION OF HIGHLY EXCITED STATES OF DOUBLY EVEN DEFORMED NUCLEI. Kyrchev, G.; Soloviev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

A generalization of the model suggested earlier for the description of intermediate and highly excited states of odd deformed nuclei is made for the case of doubly even nuclei. The wave function contains one-, two-, three- and four-phonon terms. The approximate method, taking into account the pole noncoherent terms, is used to obtain approximate solutions of the model. The system of equations is reduced to a secular equation which does not contain extraneous solutions. The obtained equations may serve as a basis for studying the structure of intermediate and highly excited states of doubly even deformed nuclei. (auth)

11599 (JINR-P4-7698) PROBLEMS IN NUCLEAR REACTION THEORY. Babikov, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. 112p. (In Russian and English). Dep. NTIS (US Sales Only) $8.75.

Eleven papers of V. V. Babikov are compiled. They discuss the meson theory of nuclear forces, the phase function method, statistical model of the average field of the nucleus, and interactions of complex nuclei. A complete list of his publications is appended. (tr-auth)

11600 (JINR-P4-7750) SPIN-ORBITAL INTERACTIONS IN DEFORMED NUCLEI. Abdulvagabova, S. K.; Shul'ts, G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The effect of the residual spin-orbital interactions on the properties of 0^+ -excitations in the even-even deformed nuclei is studied. Within the framework of the random phase method there was obtained a dispersion equation for the frequencies of the excitations when taking into account pair, quadrupole and spin-orbital forces. Numerical solutions of this equation are performed for the rare-earth nuclei. (auth)

11601 (JINR-P4-7808) DEORIENTATION OF NUCLEI AND THE ANGULAR DISTRIBUTION OF γ-QUANTA IN REACTIONS WITH HIGH MOMENTUM TRANSFER. Pham Zuy Hien. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The process of nuclear deorientation in the emission of the neutrons and γ quanta in the reactions with high momentum transfer is considered. Simple formulas are obtained for calculation of the spreading parameter of the distribution of the spin projection on the beam direction. On the basis of these results a method is proposed for calculation of the residual nucleus spin orientation and the angular distribution of discrete-spectrum γ quanta. (1 figure, 1 table) (auth)

11602 (JINR-P4-7814) STUDY OF THE INITIAL FRAGMENTATION STAGE IN SPHERICAL NUCLEI. Vdovin, A. I.; Solov'ev, V. G.; Stoyanov, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The role is discussed of the fragmentation process, (i.e., the process of distribution of the force of the one-particle or many-particle, one-phonon or multiphonon states over many nuclear levels) in the complication of the excited state structure with increasing energy. There is shown also the role of the interaction of quasiparticles with phonons in the fragmentation process. The initial stage of the fragmentation process in the even-even spherical nuclei is studied. (auth)

11603 (MATSCIENCE-78, pp 40-47) SOME UNFAMILIAR PROBLEMS IN MUON CAPTURE. Devanathan, V. (Univ. of Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The purpose of the study is to know precisely the muon capture interaction Hamiltonians and their coupling constants and to probe the nuclear structure. Attention is drawn to some other observables in the muon capture process, and the importance of investigating these observables is stressed. (JFP)

11604 (MATSCIENCE-78, pp 132-144) NUCLEAR PHYSICS IN A LARGER PERSPECTIVE. Mariwalla, K. H. (Inst. of Mathematical Sciences, Madras). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The discussion of nuclear physics covers the definition of nuclear physics, the problems and scope of nuclear theory, the strength-range relation, and the space-time dimension. (JFP)

11605 (MATSCIENCE-78, pp 145-149) POSITIVE DEFORMATION OF ODD-ODD NUCLEI AND THE CORE ROTATION. Sharma, S. D. (Panjabi Univ., Patiala, India). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

It is found that the state of positive deformation is the one having the lesser energy and thus the deformed nuclei are expected to acquire positive deformation while adjusting to the incoming nucleonic currents. The neutron and proton effects are described. (JFP)

11606 (MATSCIENCE-78, pp 239-256) EFFECTIVE INTERACTION IN NUCLEI AND REALISTIC INTERACTIONS. Joshi, K. P. (Vikram Univ., Ujjain, India). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The discussion covers the assumed forms of the equivalent potentials, the Sussex interaction, effective interactions, and a comparison with the single-particle and binding energies of oxygen-16 in a harmonic oscillator approximation. (JFP)

11607 (MATSCIENCE-78, pp 273-280) CORIOLIS AND ASYMMETRY EFFECTS ON MOMENTS OF INERTIA OF ODD–ODD DEFORMED NUCLEI. Gargi, J.; Sharma, S. D. (Punjabi Univ., Patiala, India). [nd].

From conference on nuclear physics; Mysore, India (1 Mar 1973).

The effect of k-coupling in odd–odd nuclei is studied in order to study the systematics of moments of inertia from nucleus to nucleus and also under various excitations causing the rotational patterns. The preliminary work on $\Delta k = \pm 1$ mixing was presented in A.E.E.T. symposium, 1972. The present study deals also with the asymmetry effects on moments of inertia, which cause the mixing of $\Delta K = \pm 2$ states. The results are based on the assumption that the asymmetry-effects can be treated as perturbation on the symmetric core. The results are illustrated for few cases and are found to be consistent with the classical picture of the model. The moments of inertia show the predicted trends reasonably well. (auth)

11608 (ORO-4317-38) QUALITATIVE FEATURES OF PAULI BREAK-UP FROM THE CONFIGURATION SPACE VIEWPOINT. Technical Report No. 74-092. Gambhir, B. L.; Griffin, J. J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Apr 1974. 13p. Dep. NTIS $4.00.

A dimensionless measure of the effect of Pauli exclusion upon the neutron-proton interaction in a projectile deuteron is calculated in the zero range approximation for a Hulthen deuteron. One learns thereby that the Pauli break-up matrix element is distributed differently in space from that for nuclear break-up and that the effect increases with decreasing energy to a large value at the lowest deuteron energies. (auth)

11609 (WIS-72-26-Ph) SHELL MODEL HAMILTONIANS WITH GENERALIZED SENIORITY EIGENSTATES. Shlomo, S.; Talmi, I. (Weizmann Inst. of Science, Rehovoth (Israel)). 1972. 43p. INIS.

The conditions on shell-model Hamiltonians which have eigenstates with generalized seniority $v = 0$ and $v = 2$ are stated and investigated in detail. For even semi-magic nuclei the conditions are $v = 0$ eigenstates give rise to a simple binding energy formula with terms linear and quadratic in nucleon number. If also the $v = 2$ conditions are satisfied, constant spacings, independent of nucleon number, are obtained between ground states and low-lying $J = 2, 4, \ldots$ levels. This feature is clearly demonstrated by the existence of a single-particle operator which transforms the $v = 0$ state into one with $v = 0$ and which obeys a linear equation of motion when acting on the $v = 0$ state. The constant spacings are obtained in the general case for one state with a given J, unlike the situation in the quasi-spin scheme in which there are n-independent separations between all levels. Examples are given of cases in which these conditions are actually fulfilled and yet in which the eigenstates are not those of the quasi-spin formalism. (1 table) (INIS)

11610 CANCELLATION OF THE GREEN'S FUNCTION IN THE GENERATION OF CONTINUUM BOUND STATES BY NONLOCAL POTENTIALS. Krause, T.O.; Mulligan, B. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). J. Math. Phys. (N.Y.) 15: No. 6, 770-773 (June 1974).

Continuum bound states (CBS) are known to appear in the spectra of some nonlocal scattering equations. We give a simple derivation of the presence of these states consistent with the requirement that such states occur for zeros of the Fredholm determinant. Examination of the form of the nonlocal potential necessary to the generation of a CBS shows that CBS solutions appear only when the potential has the effect of cancelling the Green's function in the kernel of the integral equation. Several examples from the literature are cited to demonstrate this characteristic feature of CBS. (auth)

11611 NEW INTERPRETATION OF THE PION–NUCLEUS OPTICAL POTENTIAL FOR PIONIC ATOMS. Barshay, S.; Brown, G.E.; Rho, M. (Institute for Theoretical Physics and Department of Physics, State University of New York, Stony Brook, New York 11790). Phys. Rev. Lett. 32: No. 14, 787-790 (8 Apr 1974).

We show that if the P-wave interaction volumes relevant for construction of the pion–nucleus optical potential used in pionic-atom studies turn out to be simply related empirically to the free-space pion–nucleon scattering volumes, then this would be indicative of both sets of quantities being dominated by the Δ (1236 MeV), which can be treated as an independent baryonic excitation in nuclei. Within this framework, we give a simple derivation of modifications to the optical potential coming from baryon–baryon short-range correlations. (auth)

11612 INNER REPULSIVE EFFECT DUE TO THE PAULI PRINCIPLE BETWEEN NUCLEAR COMPOSITE PARTICLES. Saito, S. (Nagoya Univ., Japan); Yasuno, M.; Okai, S.; Tamagaki, R. Progr. Theor. Phys. (Kyoto); 50: No. 5, 1561-1578(Nov 1973).

The effect of the Pauli exclusion principle in the short range part of interactions between nuclear composite particles is investigated in the case that there are some relative states which are not exactly forbidden but almost forbidden. These "almost forbidden states" (AFS) are coupled only weakly to the incoming relative states. Thus, the relative wave function is required to be approximately orthogonal to these AFS which are located in the inner region between composite particles. This gives rise to a strong repulsive effect characterized by the almost energy-independent inner nodal behavior as observed in the case of α-α scattering. However, at the energies characteristic of the AFS, the coupling to the AFS from the incident wave becomes very effective, and resonance-like contributions are brought about within the one-channel approximation. With respect to this feature, the Levinson theorem is discussed. (auth)

11613 INTERACTION BETWEEN IDENTICAL NUCLEI. Yukawa, T. (Massachusetts Inst. of Tech., Cambridge). Phys. Rev., C; 8: No. 5, 1593-1605(Nov 1973).

The nature of the interaction between two identical nuclei having spins zero is studied on the basis of a microscopic theory of complex collisions. The "internucleus" potential is defined such that it appears consistently in the equation of motion and the T matrix of the elastic scattering channel. It is shown that by a suitable integral transformation a strongly nonlocal potential such as that of the resonating-group method can be transformed into an l-dependent local potential with a weak nonlocal residual interaction. An application of the theory is made to a two-α particle system. The theoretical potential shows the similar l dependence to the phenomenological potential. The importance of the l dependence of the real part of the potential is discussed in relation to the elastic scattering phenomena of heavy-ion reactions. (3 figures) (auth)

11614 DEUTERON OPTICAL POTENTIAL WITH A TENSOR TERM AND BREAKUP. Keaton, P. W. Jr.; Armstrong, D. D. (Los Alamo Scientific Lab., NM). Phys. Rev., C; 8: No. 5, 1692-1701(Nov 1973).

A model for the deuteron optical potential which folds the optical potentials of the nucleons with their internal motion in the deuteron is discussed. Effects due to spin dependence, deuteron electric and nuclear breakup, and higher-order effects are incorporated more carefully than in previous articles. Approximations are used which reduce the nonlocal potential to a local potential and single-channel approach. The cross section and four analyzing tensors are calculated without any adjustment of free parameters. Good agreement is obtained in comparisons with data for 15-MeV polarized deuterons elastically scattered from ^{52}Cr, ^{56}Fe, ^{60}Ni, ^{90}Zr, ^{122}Sn, and ^{197}Au. (5 figures, 1 table, 57 references) (auth)

11615 MOLECULE-LIKE STRUCTURE IN NUCLEAR SYSTEM. Horiuchi, H. (Kyoto Univ.); Ikeda, K.; Suzuki, Y. Progr. Teor. Phys. (Kyoto), Suppl.; No. 52, 89-172(Aug 1973).

The present paper facilitates understanding about the molecule-like structure in complex nuclear systems. The first step of the work is to obtain deeper understanding of observed phenomena, from which common fundamental features are drawn. The second step is to develop the studies on more rich phenomena indicating the molecule-like structure on the basis obtained in the first step. The quantitative analysis of decay widths from the levels with di-molecule-like intrinsic structure is given, by assuming the various kinds of model wave functions for intrinsic states. The intrinsic structure of the positive-parity rotational band was examined, which is interpreted as a part of inversion doublet from the molecular viewpoint. The studies of alpha-chain series were developed on the basis of the alpha-particle model, in which parameters were determined by the properties of the ^{8}Be nucleus and were used. The studies on the levels with 3α- and 4α-chainlike configurations are summarized, and the studies on the general case of $n\alpha$-chain structures ($n \geq 5$) were developed. Discussion is given for the molecule-like structure in which heavy elements (C or O) are connected by an alpha-particle or alpha-chain. (JA)

11616 FORMATION OF THE VIEWPOINT, ALPHA-LIKE FOUR-BODY CORRELATIONS AND MOLECULAR ASPECTS IN NUCLEI. Ikeda, K. (Niigata Univ., Japan); Marumori, T.; Tamagaki, R.; Tanaka, H. Progr. Theor. Phys. (Kyoto), Suppl.; No. 52, 1-24(Aug 1973).

This paper presents the viewpoint which provides a scheme for a

deeper understanding and broader point of view about nuclear properties. The contents of this article are presented on the following conceptional basis. (1) The molecular aspects, including the aspect dominated by the alpha-like four-body correlation as a typical case, constitute one of the essential facets of nuclear structure. (2) The alpha-correlation and the molecular aspects are characterized by such property that the internal correlation in each cluster is very strong, but the external correlation between the clusters becomes weak once saturating clusters are formed. (3) The Pauli principle brings about the independent-particle aspect through the healing function in shell phase, while the Pauli principle plays a role to increase the molecular aspects through the effective exchange repulsion in molecular phase. As the most typical one of the alpha-like structures, the group of Hokkaido University selected the problem in the Be region, because ^{8}Be decays into two α-particles. Since the α-particle model was established in ^{8}Be, Hiura and Shimodaya proceed to the study of ^{9}Be with this model by properly taking into account the Pauli principle and the weak binding property of the effective potentials between $\alpha-\alpha$ and $n-\alpha$. The motivation to proceed to the next step beyond the Be region was given. One of the motivations was brought from the weak-coupling model, which indicated the importance of the alpha correlation in sd-shell nuclei. Alpha-cluster plus ^{16}O core model, approach based on the dominance of alpha-correlation mode, connection with the viewpoint of molecular structure, dual roles of the Pauli principle, coexistence of "molecular phase" with "shell phase" and its growth, justification of density localization through Hartree–Fock approach, and connection with saturation property and nuclear forces are discussed. (JA)

11617 APPLICATION OF CVC AND PCAC IN NUCLEAR WEAK INTERACTIONS. Kim, C. W. (CEN de Saclay, Gif-sur-Yvette, France). Riv. Nuovo Cim.; 4: No. 2, 189-208(1974).

The method called elementary particle treatment for the application of the hypotheses of the conserved vector current and partially conserved axial vector current to the semi-leptonic strangeness conserving nuclear weak interactions such as beta decays, muon captures by nuclei, and neutrino reactions is reviewed. This method, which involves no approximation, is to apply CVC and PCAC directly to nuclear matrix elements without explicit consideration of the initial and final nuclei being composed of the protons and neutrons. (JFP)

11618 SYMMETRIC TWO-CENTER MODEL WAVE FUNCTIONS. Badralexe, E. (Inst. of Atomic Physics, Bucharest); Rizea, M.; Sandulescu, A. Rev. Roum. Phys.; 19: No. 1, 63-80 (1974).

The two-center model with harmonic oscillator potentials is reformulated. Analytic expressions for the wave functions, normalization coefficients and matrix elements of the correction potential, which removes the original sharp cusp, are given in terms of Hermite functions. For a large distance between centers, simple expressions for eigenvalues, normalization coefficients and matrix elements are obtained, by expanding the Hermite functions around integer indices. Tables of eigenvalues, Hermite functions and normalization coefficients, necessary for any symmetric two-center shell model are given. (auth)

11619 NEW PROJECTED BASIS IN THE THEORY OF FIVE DIMENSIONAL QUASI-SPIN. Smirnov, Yu. F.; Tolstoy, V. N. (Moscow State Univ.). Rep. Math. Phys.; 4: No. 2, 97-111(Apr 1973).

The procedure for constructing the noncanonical basis corresponding to the reduction $SO(5) \supset SU_2(T) \times U_1$ valid for the arbitrary irreducible representations of the group SO(5) is developed. The proof of the completeness of this basis is given and the matrix elements of the generators are calculated in this basis. The matrix of the operator B introduced by Flowers and Szpikovsky, and specifying the effective number of alpha-like four-nucleon cluster in a nucleus is obtained and some of its general properties are discussed. (auth)

11620 FIXED PARTICLE NUMBER AND ANGULAR MOMENTUM DOUBLE-PROJECTED BCS WAVE FUNCTIONS. Fellah, M.; Hammann, T. F.; Medjadi, D. E. (Inst. of Nuclear Study, Algiers). Phys. Rev., C; 8: No. 5, 1585-1592(Nov 1973).

A method for projecting the usual BCS states simultaneously onto the eigenstates of particle number and angular momentum is suggested. Fomenko's method of projection in the occupation number space, which leads to rapidly converging series, seems to be very suitable to a subsequent projection onto the eigenstates of angular momentum. For simplicity, the deformation is restricted to be axially symmetric, and general double-projection formulas are established in this case. Simple numerical model calculations, using the adiabatic assumption, show that it is important to project the BCS states onto the particle-number eigenstates before computing the rotational spectrum and the moment of inertia. (2 figures, 4 tables) (auth)

11621 PROJECTED HARTREE–FOCK WAVE FUNCTIONS. Krishnan, R. M. (North Texas State Univ., Denton). Phys. Rev., C; 8: No. 5, 1963-1964(Nov 1973).

It is shown that the projected Hartree–Fock wave function can be considerably different from a projected Slater determinant that gives the maximum overlap with the exact shell-model wave function. This is illustrated by performing a calculation for ^{18}O and ^{18}F. (1 table) (auth)

11622 METHOD OF CORRELATED QUASIPARTICLES. III. 0^+ Particle–Particle Residual Interactions in Odd-Mass Systems. Chasman, R. R. (Argonne National Lab., IL). Phys. Rev., C; 8: No. 5, 1896-1905(Nov 1973).

Methods are developed for determining the properties of low-lying states in odd-mass systems with a residual interaction of the 0^+ particle–particle form. Using matrix elements obtained from a surface-peaked δ interaction, the methods of this paper are applied to an analysis of states in ^{239}U and ^{231}U. The results are compared with equivalent pairing-force model calculations. Substantial differences, on the order of 300 keV, are found in the single-particle energy level spectra deduced from the two residual interactions. (4 figures, 2 tables) (auth)

11623 SHAPE OF THE $\vec{t}\cdot\vec{T}$ POTENTIAL IN (^{3}He,t) SCATTERING. Hayakawa, S. I. (McGill Univ., Montreal). Phys. Rev., C; 8: No. 5, 1843-1848(Nov 1973).

Ground-state analog transitions in the (^{3}He,t) scatterings are adequately described by introducing shell effects into both real and imaginary parts of the asymmetry potential. (2 figures) (auth)

11624 PHOTON EMISSION FROM e^+e^- PAIR PRODUCTION ON NUCLEI BY HIGH-ENERGY PHOTONS. Dzhilkibaev, R. M.; Kuraev, E. A.; Fadin, V. S.; Khoze, V. A. (Leningrad Inst. of Nuclear Physics). Yadern. Fiz.; 19: No. 3, 699-702(Mar. 1974). (In Russian).

The process of the formation of e^+e^- pairs by photons in the field of the nucleus with emission of secondary photons was examined and a formula was derived for the calculated of the photon production cross section. Curves for photon emission calculated by the formula derived are compared with experimental results. The agreement is fair, but the experimental results exceed the calculated values by about 20 to 30%. (JSR)

11625 GENERAL FRAMEWORK FOR NUCLEAR-RESONANCE THEORIES IN TERMS OF THE BLOCH FORMALISM. Vitturi, A.; Zardi, F. (Univ., Padua). Nuovo Cim.; 21A: No. 4, 723-742 (21 Jun 1974).

The method of the boundary condition operator introduced by Bloch is exploited in order to set up in a compact form the "generalized collision matrices" formalism, with particular reference to the S and K matrices. It is shown that with each generalized collision matrix M a suitably defined "natural Green's function" is associated; explicit representations of this operator leads to the generalization of the Kapur-Peierls and of the Weinberg state theories. These representations enable one to consider in a simple way the analytic continuation of M and to deduce its poles and residues; for S and K matrices the results coincide with the well known ones, obtained by the matching method. One is also naturally led to consider the expansion of M in a power series of the energy; in this connection the Padé and Hadamard methods for the analytic continuation are exploited. The generalized Heitler relation holding for any two collision matrices is finally obtained. (auth)

11626 ENERGY-LEVEL CALCULATIONS WITH THE EXTENDED AROVMI MODEL. Abecasis, S. M.; Femenia, F. R. (Ciudad Univ., Buenos Aires). Comput. Phys. Commun.; 7: No. 3, 145-150(Mar 1974).

The computer program EXTARO written in FORTRAN IV for the IBM 360/50 computer is described for the theoretical values of the energy levels and ratios calculated with the extended AROVMI model in terms of the parameters γ_0 and ρ when the latter are allowed to be negative. Specifically, it yields those values concerned with the α, β, and $\alpha\beta$ and γ solutions which correspond to the original AROVMI model. (JFP)

11627 CALCULATION OF THE EQUILIBRIUM DEFORMATION OF NUCLEI WITH USE OF ONE-PARTICLE INFINITE POTENTIALS. Morozov, D. F ; Cherdantsev, P. A. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 6, 43-47(1973). (In Russian).

The method proposed by Nilsson was used for the calculation of the equilibrium deformation of X light nuclei and nuclei in the rare earth region. An anisotropic oscillator potential was used for light nuclei and the Nilsson potential for rare earths. The

isospin dependence of the oscillator frequency was used. The results agreed qualitatively with the calculations made by the Strutinsky method. (tr-auth)

11628 WHAT MAGNETIC MOMENTS TELL US ABOUT NUCLEAR FORCES AND NUCLEAR STRUCTURE. Brown, G. E. (State Univ. of New York, Stony Brook). Contract AT (11-1)-3001. J. Phys. Soc. Jap., Suppl.; 34: 3-9(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

It is noted that a relatively satisfactory description of nuclear moments has been achieved by rather empirical procedures. Most deviations from the Schmidt line could be explained by configuration mixing. However, there are fundmental questions which can only be answered at a higher level: Why is the M1 capture cross section in $n + p \rightarrow d + \gamma$ about 10% higher than the value calculated with one-body interaction operators? Why does the magnetic moment of the triton lie outside the Schmidt line? Why are there so few effects on nuclear magnetic moments from $N\frac{3}{2}$ isobars and from the tensor force, which is known to be present in the one-pion-exchange potential? What effects do exchange currents from the exchange of mesons heavier than the pion have on nuclear magnetic moments? Considerable progress has been made recently on these problems, and this is discussed in this paper. In brief, the answers have to do with various amounts of cancelation. (3 figures, 2 tables) (RWR)

11629 ROLE OF MESONS IN THE PHYSICS OF NUCLEAR MOMENTS. Miyazawa, H. (Tokyo Univ.). J. Phys. Soc. Jap., Suppl.; 34: 10-16(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Magnetic moments caused by meson exchange are discussed. For a large separation of two nucleons, the exchange moment is unambiguously predicted by pion theory. In a Fermi gas model it gives $\delta\mu_1 \sim 0.1\tau_3$, $\delta\mu_s \sim -0.2\tau_3$ for heavy nuclei and $\delta\mu \sim 0.1$ for the triton. Attempt to deal with the short distance region is presented. (auth)

11630 QUANTUM MECHANICAL CALCULATIONS OF COULOMB EXCITATION. Alder, K.; Roesel, F.; Saladin, J. X. (Univ., Basel). J. Phys. Soc. Jap., Suppl.; 34: 146-152(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Quantum-mechanical calculations of Coulomb excitation were performed within a rotational band. The deviations from a corresponding semiclassical calculation vary mostly at $1/\eta$, where η denotes the classical parameter. The order of magnitude of these corrections is for $\eta = 10$ and for the states with spin 2, 4, 6 and 8, 1%, 10%, 40% and 70%, respectively. The correction depends only slightly on the adiabaticity parameter, ξ, and the coupling strength χ. (auth)

11631 EFFECTIVE NUCLEAR MAGNETIC MOMENTS. Arima, A. (State Univ. of New York, Stony Brook). J. Phys. Soc. Jap., Suppl.; 34: 205-214(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Two mechanisms to modify the nuclear magnetic dipole operator are discussed; they are the effects of core polarization and meson exchange current. The former contributes mainly to δg_s, while the latter, to δg_l. (6 tables) (auth)

11632 ELECTRON SCATTERING AND NUCLEAR MOMENTS. Walecka, J. D. (Stanford Univ., CA). J. Phys. Soc. Jap., Suppl.; 34: 302-316(1973). See CONF-720932-.

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The general features of electron scattering are reviewed. Application is made to elastic magnetic scattering, which gives a detailed microscopic picture of the ground-state current and magnetization densities in nuclei. Transition moments observed in electron excitation of the T = 1 negative-parity oscillations in closed-shell nuclei, ^{16}O in particular are discussed, and some results of a unified analysis of semi-leptonic weak and electromagnetic interactions involving these transition moments are presented. (auth)

11633 NUCLEAR SPECTROSCOPIC QUADRUPOLE MOMENTS FROM MUONIC ATOMS AND RELATED TOPICS. Leisi, H. J.; Dey, W.; Ebersold, P.; Engfer, R.; Scheck, F.; Walter, H. K. (Swiss Federal Institut of Tech., Zürich). J. Phys. Soc. Jap., Suppl.; 34: 355-361(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Hfs splittings of "highly excited" states in exotic atoms are considered. It is shown that the quadrupole splittings of the corresponding x-ray transitions yield precise values for the spectroscopic quadrupole moment of the nuclear ground state. These quantities are model independent, in contrast to the quadrupole moments deduced from x-ray transitions between low-lying states. Experimental results on the 5g−4f and 4f−3d x-ray transitions in μ^--^{175}Lu and μ^--^{235}U are discussed. The hfs components in pionic atoms show, apart from their electromagnetic splitting, a shift and a width due to the strong interaction of the pion, which is different for different angular momentum states. The effect of this phenomenon on the level positions may be described by an additional quadrupole coupling constant. An experiment on the quadrupole splitting of the 5g−4f transition in π^--^{175}Lu is described. (4 figures) (auth)

11634 NEW SURPRISES IN CONNECTION WITH STATIC MOMENTS, AND OTHER ANHARMONIC EFFECTS. Soerensen, B. (Univ. of Copenhagen). J. Phys. Soc. Jap., Suppl.; 34: 399-406(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

After a brief introduction, the boson variational approach to collective motion is introduced, and the results of such a calculation for three values of quadrupole strength covering a quadrupole phase transition are shown. The results of the boson variational method are compared with an exact solution in a 4-level model. The effective force in many-body calculations with a truncated configuration space is discussed. Static quadrupole moments of 2^+ states in Cd and Te isotopes are calculated. (9 figures) (RWR)

11635 MAGNETIC MOMENTS AND ELECTROMAGNETIC TRANSITION RATES OF THE ANOMALOUS COUPLING STATES WITH SPIN I = j − 1. Kuriyama, A. (Kyushu Univ., Fukuoka); Marumori, T.; Matsuyanagi, K. J. Phys. Soc. Jap., Suppl.; 34: 407-415(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Various electromagnetic properties of the anomalous coupling states (ACS) with spin I = j − 1 are shown to be well explained by a new point of view on structure of the ACS. In the new point of view, the ACS are considered as the dressed three-quasi-particle modes which are regarded as a kind of elementary excitation mode in odd-mass nuclei. (3 figures, 3 tables) (auth)

11636 E2 TRANSITION ENERGIES AND ROTATIONAL ENERGY FORMULAE. Sood, P. C.; Mantri, A. N. (Banaras Hindu Univ., India). J. Phys. Soc. Jap., Suppl.; 34: 453-455 (1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11637 MOMENTS OF INERTIA FOR ROTATING DEFORMED NUCLEI. Mantri, A. N.; Sood, P. C. (Banaras Hindu Univ., India). J. Phys. Soc. Jap., Suppl.; 34: 456-459(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

11638 EFFECTS OF CONFIGURATION MIXING ON NUCLEAR MOMENTS. Horie, H. (Tokyo Inst. of Tech.). J. Phys. Soc. Jap., Suppl.; 34: 461-469(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Effects of configuration mixing on nuclear moments were investigated. Expressions of the effects for higher-seniority states of the identical-nucleon system were obtained. As an example of proton−neutron systems, nuclear moments of the $1f_{\frac{7}{2}}$ nuclei were discussed; and importance of the consideration of isospin is pointed out, especially for the N = 28 nuclei. (5 figures, 4 tables) (auth)

11639 RENORMALIZATION OF THE E0, M1, AND E2 OPERATORS. Zamick, L. (Rutgers−The State Univ., New Brunswick, NJ). J. Phys. Soc. Jap., Suppl.; 34: 470-474(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The transition rate of the 0_2 state in ^{208}Pb is dominated by the E0 process to the ground state; $B(E2, 0_2 \rightarrow 2_1)$ is strongly suppressed. It is found that the simplest explanation of the strong E0 rate is that the E0 effective charge is state dependent. The effective charge can be obtained empirically from the isotope shifts. Then some remarks are made concerning the M1 operator, and it is noted that in the nucleus the two-body operator behaves like a one-body operator, and the one-body operator behaves like a one- and two-body operator. This situation is discussed with respect to the $1f_{\frac{7}{2}}$ nuclei. Ground-state moments and M1 rates are also touched upon briefly. Finally, E2 moments are addressed as occurring in calculations of the effective charges of ^{17}O. The question of state dependence is still open. (2 figures) (RWR)

11640 COMMENTS ON THE MESONIC EFFECTS IN NUCLEI. Rho, M. (CEN de Saclay, Gif-sur-Yvette, France). J. Phys. Soc. Jap., Suppl.; 34: 489-492(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Several aspects of mesonic effects in nuclei are addressed. The matter of mesonic degrees of freedom has no systematic method on which to rely. This is illustrated by considering the three-nucleon system and the N*. It is hoped that a generalization of Cutkosky's Heitler–London picture (originally used for the deuteron) may resolve the problem. Then the mesonic correction to $\langle \tau_3 \sigma \rangle$ in heavier nuclei is considered. Methods other than the study of magnetic moments which should contribute to our understanding of the way mesons function nuclei are also discussed. (3 figures) (RWR)

11641 ORBITAL g-FACTOR AND E1 SUM RULE. Fujita, J. I. (Tokyo Univ. of Education). J. Phys. Soc. Jap., Suppl.; 34: 493-497(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Recently it was pointed out that there exists a simple geometrical relationship between the change of an orbital g-factor due to exchange currents and the sum rule for E1 photoabsorption. Theoretical accuracy and physical implication of the relation are discussed from various viewpoints. (1 table) (auth)

11642 RELATIVISTIC CORRECTION TO NUCLEAR MAGNETIC MOMENT. Ohtsubo, H.; Sano, M.; Morita, M. (Osaka Univ.). J. Phys. Soc. Jap., Suppl.; 34: 509-512(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The treatment of the relativistic corrections to the nuclear magnetic moment and the Gamow–Teller matrix element for beta decay are reported in a general way. The motion of a nucleon inside the nucleus can be described by the Dirac equation with an effective potential. Numerical values for the correction are tabulated in nuclear magnetons for nuclei with A = 11 to 208. Similar corrections to the Gamow–Teller matrix elements for beta decay of mirror nuclei are necessary. In this case the correction depends on both j and l, whereas in the magnetic moment case it depends only on j. It is found that the relativistic corrections cannot be neglected in either case. (1 table) (RWR)

11643 RECENT EXPERIMENTAL AND THEORETICAL STUDIES OF NUCLEAR STRUCTURE EFFECTS ON HYPERFINE STRUCTURE. Stroke, H. H. (New York Univ., NY). J. Phys. Soc. Jap., Suppl.; 34: 543-552(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Recent nuclear structure studies through the electron–nucleus interaction, including systematics of quadrupole moments, isotope shifts, and hyperfine structure anomalies, are presented. The charge structure effect on hfs was recalculated with a diffuse distribution. Progress in accounting for the specific mass contribution to isotope shift, binding energy–radius relations, and new experimental techniques is discussed. (auth)

11644 INTERPRETATION OF HYPERFINE INTERACTION DATA. Kankeleit, E. (Technische Hochschule, Darmstadt, Ger.). J. Phys. Soc. Jap., Suppl.; 34: 553-564(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The energy of electric or magnetic interaction of an atomic muon or electron is obtained from an integral which contains the product of two functions belonging to the nucleus and the particle. If the function of the particle is approximated by $a_0 + a_2r^2 + a_3r^3$, the interaction energy can be discussed in terms of the extension and the structure of a nuclear distribution independent of scale. As examples recent muonic experiments on isomer shift and hyperfine anomaly are discussed. The application of this parameterization to elastic electron scattering is briefly mentioned. (10 figures) (auth)

11645 HIGHER NUCLEAR DEFORMATIONS FROM THE BOUND-MUONIC POINT OF VIEW. Konishi, T.; Narumi, H. (Hiroshima Univ.). J. Phys. Soc. Jap., Suppl.; 34: 565-568(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

The contribution of the Y_4 deformation to the transition matrix elements of the muon–nucleus system is considered, and the intrinsic quadrupole moment is reevaluated for several nuclei for which a large Y_4 deformation parameter is expected. A modified Fermi charge distribution is assumed and then expanded. The electric multipole interaction of the muon–nucleus system and pertinent eigenfunctions are written down. The influence of the Y_4 deformation is discussed in comparing theoretical with observed values of the charge distributions and the E2 moments obtained from muonic spectra. For ^{152}Sm and ^{184}W, the Y_4 effect causes changes of several per cent. When the Y_4 deformation is taken into account, the value of the E2 moment is seen to increase or decrease as the sign of the deformation parameter. The corrections considered are of the order of magnitude of the experimental errors; however, the analysis of the Y_4 deformation from the muonic point of view might be more in line with the accuracy obtainable in muonic and other model-independent experiments. (1 table) (RWR)

11646 BETA-DECAY OF BOUND NUCLEONS. Wilkinson, D. H. (Nuclear Physics Lab., Oxford). J. Phys. Soc. Jap., Suppl.; 34: 572-575(1973).

From international conference on nuclear moments and nuclear structure; Osaka, Japan (4 Sep 1972). See CONF-720932-.

Several differences between the beta decay of nucleons bound into complex nuclei and free nucleons are mentioned. Two points in particular are discussed: The ft values in mirror Gamow–Teller β decay may differ, depending on whether the neutron-rich or neutron-poor member is decaying; the Gamow–Teller strength of β decay of well-defined $\langle \tau\sigma \rangle$ in complex nuclei would permit the definition of an effective axial coupling constant, g_{A_e}, renormalized from that, g_A, of the free neutron by the nuclear binding forces. With reference to the first point, it was found that the even-A systems give no evidence for second-class effects in the hadronic weak current at the 99% confidence level; the odd-A systems show a large asymmetry, but this is not unexpected. The chief problem in extracting g_{A_e} is lack of reliable knowledge of $\langle \tau\sigma \rangle$; nevertheless, the following result was obtained: $g_{A_e}/g_A = 0.920 \pm 0.047$. (1 table) (RWR)

11647 NUCLEAR STRUCTURE PHYSICS. Proceedings of the Minerva Symposium on Physics, Rehovoth, Israel April 2–5, 1973. Smilansky, U.; Talmi, I.; Weidenmueller, H. A. (Eds.). Lecture Notes in Physics, Volume 23. Berlin; Springer-Verlag (1973). 306p. (CONF-730450-). $10.70.

Separate abstracts were prepared for each of the papers in this book. (RWR)

For abstracts of individual papers see: 10520, 10521, 11403, 11441, 11442, 11468, 11520, 11521, 11575, 11648–11651, and 11697.

11648 SINGLE PARTICLE PROPERTIES OF NUCLEI. Weidemueller, H. A. (Max-Planck-Institut fuer Kernphysik, Heidelberg). pp 1-15 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

Landau's concept of quasiparticles is used to discuss certain single-particle properties of nuclei, and to relate experimental removal energies with calculated single-particle energies. The importance of single-particle motion in nuclei is stressed. (5 figures, 1 table) (auth)

11649 EFFECTIVE INTERACTIONS IN NUCLEI. Kirson, M. W. (The Weizmann Institute of Science, Rehovoth, Israel). pp 58-73 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

This survey concentrates on a few specific areas in which the microscopic theory of nuclear effective interactions might encounter problems and where further study would be useful. Material already freely available in the literature is not repeated; however, an attempt is made to keep the work self-contained by including brief descriptions of the background and framework of the calculations where needed. The essential problem is to define and calculate, from the bare nucleon–nucleon interaction, an effective interaction that can partially account for observed nuclear spectra despite drastic limitation of the number of degrees of freedom of the nucleus. The framework is the nuclear shell model; the tool, many-body perturbation theory. It is assumed that the nuclear single-particle model, with a small number of active nucleons confined to a few single-particle orbits, can give a reasonable description of low-energy nuclear spectra, provided the interaction between nucleons is renormalized to take into account the effects of the many neglected configurations. The neglected configurations define a set of intermediate states which can be virtually excited by the interaction between nucleons. High-energy intermediate states are handled by the Brueckner G matrix. While at first sight the terms in low orders of perturbation theory remain reasonably small, this supposition is strongly challenged by the empirical observation of "intruder" states in nuclear spectra. Perturbation theory calculations remain valid if the intruder states are not included, but then detailed comparison of the results with experiment is meaningless. It can be shown, however, that suitable partial summations allow the analytic continuation of

the perturbation expansion beyond the intruder branch points. In conclusion, the theory of the nuclear effective interaction, though apparently quite well understood, still contains weak points, especially in connection with the single-particle aspects of the problem and with the treatment of high-energy intermediate states, but a reasonably coherent and consistent calculation appears possible. (11 figures) (RWR)

11650 SHAPE OF THE FISSION BARRIER. Specht, H. J. (Univ., Munich). pp 105-128 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

In the collective model of the nucleus, the nuclear shape can be appropriately described by a few dynamical variables. Attention is focused on the unusual shapes of heavy fissioning nuclei and the dependence of the nuclear potential energy surface on the most important of these variables describing the shape—the quadrupole (elongation) and the octupole (left-right asymmetry) degrees of freedom. Relative to the former, rotational levels and the moment of inertia of fission isomers, attempts at higher-lying bands and quantum numbers of isomeric states, and possibilities for measuring the quadrupole moment are discussed. As for the octupole degree of freedom, barrier heights for symmetric and asymmetric fission are examined. (17 figures) (RWR)

11651 COMMON ASPECTS IN FISSION AND HEAVY ION REACTIONS. Dietrich, K. (Technische Univ., Munich). pp 129-147 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

A possible connection between fission and heavy-ion reactions (HIR) due to reciprocity is explored first. Then a number of topics common to fission and HIR are discussed. Fission and heavy-ion reactions as general forms of collective motion: theory of collective variables is taken up first; the semiclassical approach, cranking theory and time-dependent Hartree-Fock, and the generator-coordinate method (GCM) are included. After a brief discussion of shell effects, statistical effects and optical potentials and nuclear viscosity are treated. Then the multiple transfer of particles or quanta is considered; the various aspects included are symmetry violation in both parts of the system and degenerate bosons in both parts of the system. Finally, the study of electronic transitions following a HIR or fission is described. (3 figures) (RWR)

11652 ELASTIC SCATTERING OF HEAVY IONS IN TWO-CENTER MODEL. Vershinin, G. A.; Cherdantsev, P. A. (Tomsk Polytechnic Inst., USSR). Yadern. Fiz.; 19: No. 5, 1019-1031 (May 1974). (In Russian).

The elastic scattering of heavy ions is treated in the framework of the optical model in which the real part of the ion-ion potential is determined by Strutinsky method with using the two-center shell potential. It is supposed that in collisions nuclei are deformed by Coulomb and nuclear forces and when two nuclei touch each other a nuclear molecule is formed. The molecule rotates round the axis passing through the center of mass of the system. The calculated real parts of the ion-ion potentials essentially depend on the structure of colliding ions and have a repulsive core. It is concluded that the intermediate structure of the excitation functions is determined by the behavior of the potential energy in the vicinity of the equilibrium value of deformation. (auth)

11653 MODEL DESCRIBING THE FRAGMENTATION OF SINGLE- AND MANY-PARTICLE STATES OVER THE LEVELS OF AN ODD SPHERICAL NUCLEI. Vdovin, A. I.; Solov'ev, V. G. (Joint Inst. for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 19: No. 2, 275-282 (May 1974). (In Russian).

A model describing the structure of intermediate excitation energy states and highly excited states in odd spherical nuclei is considered. The process of fragmentation that is responsible for the complication of the state structure with increasing excitation energy is described by means of the interaction of quasiparticles with different type phonons. Basic equations of the model suggested are derived. A method of calculating the density of highly excited states in odd-mass spherical nuclei is proposed. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 9584, 9713, 9944, 10883, 10884, 10920, 11096, and 11120.

11654 (GSF-H-216) RADIATION HAZARDS DURING REPAIR AND MAINTENANCE WORK IN A POWER REACTOR. Poetzsch, P. (Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Muenchen (F. R. Germany). Inst. fuer Haematologie). Dec. 1972. 63p. (In German). INIS.

Thesis. Submitted to Univ., Munich.

The clinical and physical measures currently available in radiation protection monitoring are demonstrated. Nine workers belonging to the staff of a nuclear power plant have been examined for possible incorporations after the annual shutdown period for repair and maintenance purposes. Incorporations of ^{58}Co, ^{60}Co, ^{134}Cs, ^{137}Cs and ^{131}I could be detected by means of whole-body counting and excretory analysis in all nine workers, with values well below 4% of the MPC. Together with their wives, the workers have been examined for incorporated ^{137}Cs in order to exclude differences in regions and diet. No ^{137}Cs has been found in the urine of wives and control persons. (GE)

11655 (GSF-S-244) LOCAL X-RAY DOSE IN THE RADIOGRAPHICAL ROOM IN RELATION TO FIELD SIZE AND THE SETUP OF DENTAL X-RAY DEVICES (WITH SPECIAL REGARD TO THE RESULTS OF THE ROEPAK METHOD). Sauter, F. (Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). Jul 1973. 81p. (In German). INIS.

Thesis. Submitted to Univ., Munich.

The aim of this work was to determine the local x-ray dose at the height of the gonads of the dentist or his personnel in dependence of the field size of the effective beam bundle at the tube head. For the experimental measurements, the x-ray device has been adjusted to the molars of the superior maxilla. The local dose has been measured at various distances and different angles to the center beam. 3,250 dose measurements have been performed. It is shown that 1) the most suitable position during radiography of the upper molars is at an angle of 270° to the center beam at a distance of 2 m, i.e. an angle of 90° behind the patient. If this position is not possible, a position of 90° can be recommended, 2) the rejection to operate the x-ray device at the unit itself cannot be maintained because the local doses are increased at the lateral wall and in the corner, 3) the use of a long tube results in a significant local dose reduction compared with the short one, 4) the occurring local doses at an angle of 90° increase about proportionally with the field size, 5) a delimitation of control and surveillance area is hardly possible in dental practice in compliance observed with radiation protection requirements, because the surveillance area does not exceed a radius of 1 m for an average number of x-ray examinations (1,250 radiographs/year). (GE)

11656 (INIS-mf-1265) EXPERIMENTAL MEASUREMENT OF BETA SCATTERING IN AIR. Bhanti, D. P.; Dua, S. K. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). 1973. 6p. INIS.

From 1st annual conference of Indian Association for Radiation Protection; Bombay, India (12 Apr 1973).

Studies have been carried out on the scattering of beta rays in air using (a) collimated beams and (b) an open source. The collimation is obtained by using two circular apertures of 0.32 cm diameter placed in line with the source. The distribution of the direct and the scattered components of the beam obtained at various distances from the place of its emergence, is discussed. The effect of air density on the scattering is studied. The estimation of scattered radiation from an open point source at a known distance is done by interposing a suitable absorber between the source and the detector and the results are presented. (auth)

11657 (IPF-71-6) TRANSPORT EQUATION FOR A NON-ISOTHERMAL GAS MIXTURE AND CALCULATION OF THE STATE PARAMETER BY GRAD'S METHOD. Schwoerer, K. (Stuttgart Univ. (TH) (F.R. Germany). Inst. fuer Plasmaforschung). 1971. 96p. (In German). INIS.

Derivation of transport equations (particle, momentum and energy density) for one component of ideal gas mixtures and of momentum and heat flow from kinetic equations for one-particle distribution functions by Grad's 13-momentum approximation. The components may be electrically charged and of different temperatures, whereas the potentials and magnetic fields vary slowly. The collision integrals for inelastic collisions were calculated from Boltzmann's collisional terms and reduced to $\Omega^{(l,s)}$-integrals. The range of applicability of this approximation and the treatment of inelastic collisions in molecular gases and plasma are discussed. The numerical results for the plasmas are given to demonstrate the calculation of fluxes and transport coefficients from momentum transport equations. (GE)

11658 (N-74-10630) TRANSPORT ANALYSIS OF MEASURED NEUTRON LEAKAGE SPECTRA FROM SPHERES AS TESTS OF EVALUATED HIGH-ENERGY CROSS SECTIONS. Bogart, D. D.; Shook, D. F.; Fieno, D. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Nov 1973. 40p. (NASA-TN-D-7485; E-7327). NTIS $3.00.

Integral tests of evaluated ENDF/B high-energy cross sections have been made by comparing measured and calculated neutron leakage flux spectra from spheres of various materials. An Am-Be (alpha,n) source was used to provide fast neutrons at the center of the test spheres of Be, CH2, Pb, Nb, Mo, Ta, and W. The absolute leakage flux spectra were measured in the energy range 0.5 to 12 MeV using a calibrated NE213 liquid scintillator neutron spectrometer. Absolute calculations of the spectra were made using version 3 ENDF/B cross sections and an S_n discrete ordinates multigroup transport code. Generally excellent agreement was obtained for Be, CH2, Pb, and Mo, and good agreement was observed for Nb although discrepancies were observed for some energy ranges. Poor comparative results, obtained for Ta and W, are attributed to unsatisfactory nonelastic cross sections. The experimental sphere leakage flux spectra are tabulated and serve as possible benchmarks for these elements against which reevaluated cross sections may be tested. (auth) (STAR)

11659 (ORNL-TM-4590) CALCULATION OF RESIDUAL NUCLEI PRODUCTION BY A BEAM OF NEGATIVELY-CHARGED PIONS INCIDENT ON A TISSUE PHANTOM. Armstrong, T. W.; Chandler, K. C. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 17p. Dep. NTIS $4.00.

Monte Carlo calculations have been carried out to determine the depth dependence of the residual nuclei produced in tissue by a negatively-charged pion beam. In addition, the depth dependence of those residual nuclei which are β^+ emitters and the photon energy produced by π^0 decay and nuclear de-excitation are computed since these photon sources have been proposed as a possible means of monitoring the treatment volume during radiotherapy using π^- beams. (auth)

11660 (SLA-74-284) BIBLIOGRAPHY ON INVARIANT IMBEDDING AND RELATED TOPICS. Scott, M. R. (Sandia Labs., Albuquerque, N. Mex. (USA); Sandia Labs., Livermore, Calif. (USA)). Jun 1974. Contract AT(29-1)-789. 120p. Dep. NTIS $9.00.

A collection of over 500 journal articles and books on the method of invariant imbedding and several related topics are presented. The bibliography is divided into two parts, a subject catalog and an author catalog. Each article contains the author or authors, the title, journal, volume number, year of publication, and page numbers. (auth)

11661 (SLA-74-5153) ELECTRON TRANSPORT IN THE PRESENCE OF UNIFORM MAGNETIC FIELD. Halbleib, J. A. Sr. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 4p. (CONF-740707-5). Dep. NTIS $4.00.

From annual conference on nuclear and space radiation effects; Fort Collins, Colorado, USA (15 Jul 1974).

A model is presented which describes the transport of electrons through material in the presence of uniform macroscopic magnetic fields. It combines the analytic features of the vacuum field transport with existing condensed-history collisional Monte Carlo. It has been applied extensively to problems in pulsed electron-beam research. (auth)

11662 (SLA-74-5154) ONE DIMENSIONAL MODEL OF COUPLED ELECTRON-PHOTON TRANSPORT. Halbleib, J. A.; Vandevender, W. H. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 4p. (CONF-740707-6). Dep. NTIS $4.00.

From annual conference on nuclear and space radiation effects; Fort Collins, Colorado, USA (15 Jul 1974).

The TIGER code, a one-dimensional multislab model, is described for coupled electron-photon transport. A comparison with experimental results is discussed. (JFP)

11663 PRODUCTION OF INTENSE MONOCHROMATIC RADIATION BY X-RAY FLUORESCENCE. Chartier, J. L. (CEN, Fontenay-aux-Roses, France); Portal, G.; Roman, D.; Dugay, D. pp 129-151 of Seventh National Congress of the Health Physicist's Association. Marseilles; Centre National de la Recherche Scientifique (1973). (In French)

From seventh national congress on control of ionizing radiation: pollution, dosimetry, applications; Marseilles, France (16 May 1972).

Research and development in the field of radioprotection dosimetry necessitate the availability of monochromatic radiation beams. The narrow spectra of such beams are used to determine the spectral sensitivity of dosimeters. Monochromatic beams have beams produced by exploiting the x-ray fluorescence phenomena associated with the electron shell structure reorganization of atoms subjected to photoelectric type interactions. Only the Kα1 and Kβ2 doublet is retained. A prototype set-up was used to study the various parameters together with their effects on the purity and intensity of the beams obtained. The currently operating operation which provides x radiation in the 5- to 100-keV energy range was developed from this prototype. The application of beam spectrometry techniques led to a definition of the purity of the radiation. The method used is described. The exposure rates for different element targets are given for two different radiation purity levels. (FR)

11664 BCRU COMMENTS ON ICRU REPORT 19. Moore, R. D. (Western Park Hospital, Sheffield, Eng.). Brit. J. Radiol.; 47: No. 557, 297(May 1974).

Brief comment is made on the confusion arising from the recommendation by the BCRU (Br. J. Radiol, 46: 733-744(1973)) to adopt the term "exposure rate constant" as a replacement for "specific gamma-ray constant." (UK)

11665 POSSIBILITIES AND LIMITS OF FILM DENSITOMETRY FOR THE DETERMINATION OF DOSE DISTRIBUTIONS IN RADIOTHERAPY. Rassow, J. (Univ., Essen). pp 306-319 of Densitometrie in der Radiologie. Heuck, F. (ed.). Stuttgart; Thieme (1973). (In German).

From meeting of the Gesellschaft fuer Biomedizinische Technik and the Deutsche Roentgengesellschaft; Stuttgart, Germany (1971).

By a normalizing method, the influence of errors caused by emulsion and developing fluctuations can be decisively diminished. For fixed field irradiations the change of film sensibility for different points of measurement within homogeneous phantoms is to be corrected by the "energy factor" F_E and the "relative phantom depth factor" F_p. For pendulum dose distributions it is necessary that the factor F_p for the radiation should not differ much from the value 1 as is the case for high energy photons and electrons. The elimination of systematical errors in inhomogeneous phantoms is practically impossible. It is demonstrated for the example of electrons that the inevitable errors are less for pendulum irradiations, even for small angles, due to the spatial homogenization and levelling of hot spots and high film sensitivity changes by the moving field technique. (GE)

11666 FUNDAMENTALS OF RADIOLOGICAL SCIENCE. Hale, J. Springfield, IL; Charles C Thomas, Publisher (1974). 352p.

After a review of the basic mathematics and physics essential in the study of radiological science, a study is made of atomic and nuclear physics, the radiation field, and the interaction of radiation with matter. Finally, the fundamentals of dosimetry are discussed. The material is directed toward first year residents in radiology. (MHR)

11667 X-RAY PHYSICS FOR RADIOLOGIC TECHNOLOGISTS. Schmidt, R. H. St. Louis; Warren H. Green, Inc. (1973). 153p. $10.00.

This book assumes a high school background with little or no knowledge of mathematics and science. The following chapters are included: atomic structure, potential and kinetic energy, magnetism and behavior of magnets, mechanical production of electricity transformer, development of the x-ray tube, voltage and polarity control, x-ray tube details, x-ray machine electric circuits, the nature of rays, production of x-rays, x-ray interaction with matter, and radiation therapy. (MHR)

11668 SPATIAL ENERGY DISTRIBUTION AROUND HEAVY-ION PATH. Fain, J.; Monnin, M.; Montret, M. (Univ. of Clermont, Clermont-Ferrand, France). Radiat. Res.; 57: No. 3, 379-389(Mar 1974).

A theoretical model to calculate radial energy deposition, around a heavy-ion path, has been presented. The method of calculation involves evaluation of energy deposition through such basic processes as ionization, excitation, and vibration of the medium molecules. Partition of energy deposition into various modes has enabled us to compute W values, energy required to create one ion pair, in various media. Incident particle energies have been chosen in such a way that retardation of the particle is caused mainly by electronic interactions. Wherever possible, comparison has been made with experimental results as well as other theoretical models. Agreement with available experimental results and results of another theoretical model is very reasonable. (auth)

11669 TRANSVERSAL TOMOGRAPHY AND ITS ACCURACY IN DOSE PLANNING. Pitkaenen, U.; Kiviniitty, K. (Oulu Univ., Finland). Strahlentherapie; 146: No. 5, 562-565(Nov 1973). (In German).

A computer program for calculating the modulation transfer functions (MTF's) of the multiple form density distributions is developed. By means of this method, two transversal tomography units are compared with each other. (GE)

11670 CONTRIBUTION TO DEEP ELECTRON THERAPY BY PENDULUM IRRADIATION. VII. Dosimetry and Example for the Application of Telecentric Pendulum Irradiation with Electrons of 5 to 10 MeV Under Changing Focus-Skin Distance. Huedepohl, G.; Rassow, J. (Univ., Essen). Strahlentherapie; 146: No. 5, 546-558(Nov 1973). (In German).

An appropriate method for shell-irradiations with axial depths between 30 and 15 cm is described. Besides the investigation concerning the way to derive pendulum isodoses for different focus-skin-distances from a known pendular dose distribution, two methods for the determination of the reference dose under changing focus-skin-distance are described. At first the determination is made through direct measurement during the pendulum movement, then through the reference dose calculated from a known pendulum field, through conversion by means of three influence factors, depending on the focus-skin-distance. These factors can be found either experimentally on fixed fields or by calculation. A clinical example indicates the advantage of a pendulum movement with large focus-skin-distance. (GE)

11671 DOSE DISTRIBUTION IN MOVING BEAM THERAPY WITH ULTRAHARD PHOTONS. II. Sommer, F.; Schmidt-Hermes, H. J.; Munzinger, D. (Universitaet de Saarlandes, Homburg, Ger.). Strahlentherapie; 146: No. 5, 541-545(Nov 1973). (In German).

With membrane chambers, systematic experiments were performed on the Alderson phantom under biaxial pendulum irradiation with 42 MeV photons under various field breadths and distances of the pendulum axis. The ascertained dose distribution is reproduced by isodoses. The individual isodoses are discussed; the applicability of the different irradiation methods in clinical practice is demonstrated. (GE)

11672 DOSE DISTRIBUTION IN MOVING BEAM THERAPY WITH ULTRAHARD PHOTONS. I. Investigations for Centric and Eccentric Monoaxial Pendulum Irradiation. Sommer, F.; Schmidt-Hermes, H. J.; Rohr, P.; Wilhelm, U. (Univ. Saarlandes, Homburg, Ger.). Strahlentherapie; 146: No. 5, 537-540(Nov 1973). (In German).

Dose distributions under eccentric and centric monoaxial pendulum irradiation and various breadths of the axial field with ultrahard photons of different energy are compared. Hereby, the maximum pendulum angle (180°) of the 42-MeV-Siemens-Betatron always is used. From the ascertained isodoses one can gather that this mode of irradiation is practicable in certain focal localizations (by example one part of the minor pelvis or of the lungs and centrally situated processes). (GE)

11673 MONTE CARLO SIMULATION OF THE TRANSPORT OF FAST NEUTRONS THROUGH THICK LAYERS OF MATTER. Schmidt, F. Stuttgart; Univ. Stuttgart (1972). 111p. (In German). (IKE-6-48).

Thesis.

Processes which greatly deviate from the mean cause the main difficulty in rationally selecting the unusual occurrences. There are special techniques advantageous for the weighting of the nature-determined probability distribution. In the present work the transport of fast neutrons through thick layers of matter is explained. In some unusual cases a neutron penetrates through the shielding. The chances of this happening can be estimated with the help of suitable weighting functions. A method is proposed with which the energy, angle and dependent weighting functions can easily be determined. Empirical statements of other authors can be theoretically explained with the obtained functions, their results interpret the new statement also. The possibilities of using the functions in a Monte Carlo program are discussed and verified by some calculated examples. This shows that problems of various natures can be treated by the proposed weighting methods. (GE)

11674 THEORETICAL EVALUATION OF PLASTIC DOSIMETRY PHANTOMS. Peschel, R. E.; Schulz, R. J. (Yale Univ., New Haven). Phys. Med. Biol.; 19: No. 2, 171-185(Mar 1974).

An analytical model for the calculation of dose per unit photon fluence along the central axis of circular fields has been developed. The required input data are phantom density, mass attenuation and mass energy absorption coefficients, and differential Compton scattering cross-sections. The accuracy of the model was assessed by comparing calculated f factors and central axis depth dose in water to published results for ^{137}Cs and ^{60}Co γ-ray beams. The model,

which may be in error by as much as 5% for ^{137}Cs depth dose, reproduced ^{60}Co data to better than 2%. The principal source of error is attributed to an approximation in the calculation of dose from tertiary scatter, and this should diminish for higher energy incident beams. The model has been used to compare plastic and water dosimetry phantoms for the calibration of high-energy X- and γ-ray beams according to the 1971 recommendations of the AAPM. The results indicate that the use of polystyrene or Lucite dosimetry phantoms will cause an over-estimation in the determination of dose to water by less than 1% for most high-energy beams. (auth)

11675 DOSIMETRY OF ^{129}Cs: FURTHER COMMENTS. Feller, P. A.; Kereiakes, J. G. (Food and Drug Administration, Washington, DC). Phys. Med. Biol.; 19: No. 2, 220-221(Mar 1974).

Using Horen's decay information, (Nucl. Data, Section B, 8, 123, 1972), a table of dosimetry parameters associated with ^{129}Cs has been compiled. Values were obtained for the non-penetrating and penetrating components of the Total Equilibrium Dose Constant ($\Sigma_i \Delta_i$) of 0.0351 and 0.5970g rad $\mu Ci^{-1}h^{-1}$, respectively, compared with 0.0607 and 0.8362g rad $\mu Ci^{-1}h^{-1}$, as calculated using a decay scheme published by Lederer et al. (Table of Isotopes, 6th edn. 1967). Using the newer data, a total body absorbed dose was calculated of 0.17 rad/mCi administered. This represented a 32% decrease from the previous calculations. (UK)

11676 MINIMIZING SURFACE DOSE WITH MEDIUM Z ELECTRON SHIELDS. Baum, J. W.; Phillips, L. F. (Brookhaven National Lab., Upton, NY). Phys. Med. Biol.; 19: No. 2, 223-225 (Mar 1974).

Experiments were made using shields against surface doses resulting from electrons ejected from the source and collimator. A stainless steel clad ^{60}Co source was used at the rear end of a 10.2 cm dia. by 20.3 cm deep hole in a lead collimator. A screen window ionization chamber measured dose in the first 25 μm of tissue. To determine the ratio of surface to penetrating dose, measurements were made with and without a 2.5 mm Lucite absorber directly in front of the ionization chamber with no electron shield, the surface to penetrating dose increased from ~0.97 to 2.4 as the detector to source distance was varied from 300 to 26 cm. A 3.2 mm electron shield over the beam port at source resulted in a surface to penetrating dose falling from 0.98 at 300 cm to 0.90 at 60 cm, rising to 1.03 at 26 cm. It is suggested that the ratio improvement obtained by using copper instead of Lucite was because fewer forward scattered electrons are produced in shields of intermediate Z. The importance is stressed of using a medium Z electron shield near the source for ^{60}Co therapy. (UK)

11677 SI UNITS IN RADIATION MEASUREMENT. Ramsey, N. W. (Charing Cross Group of Hospitals, London). Brit. J. Radiol.; 47: No. 557, 296(May 1974).

The value of the SI system in the radiological field is questioned, with particular reference to the prescription of a dose of radioactivity as so many "per seconds," and to the SI unit of exposure, stated as coulomb per kilogram. The case is argued for retaining special names for quantities of activity, exposure and absorbed dose. (UK)

11678 SPECIAL RADIATION UNITS AND/OR SI UNITS. Liden, K. (Univ. of Lund, Sweden). Brit. J. Radiol.; 47: No. 557, 295(May 1974).

Attention is drawn to an ICRU statement included in its report to the 13th International Congress of Radiology 1973, concerning special radiation units in relation to the international system. Further comment is invited from the radiological and health physics community, particularly before the ICRU meeting in July 1974. Particular reference is made to the quantity dose equivalent, H, and its unit 1 rem. A change to the SI unit 1 J. kg^{-1} would produce a unit 100 times greater. (UK)

11679 SI UNITS IN RADIOLOGY AND RADIATION MEASUREMENTS. Osborne, R. V. (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Brit. J. Radiol.; 47: No. 557, 296(May 1974).

A suggestion is made that the use of the hertz would overcome the practical problems involved in expressing the curie in SI units. (UK)

11680 SI UNITS FOR RADIATION MEASUREMENTS. Reddy, A. R.; Nagaratnam, A. (Inst. of Nuclear Medicine and Allied Sciences, Delhi). Brit. J. Radiol.; 47: No. 557, 295(May 1974).

Mention is made of the simplification brought about by the fact that equilibrium absorbed dose constant, integral dose and the energy of particulate and electromagnetic radiations all have the same unit, joule, in the SI system. Attention is also drawn to position of "cumulated activity" μCi-h within the system and the fact that nuclear transformation does not fit neatly into one of the 7 base units of the SI systems. (UK)

11681 SPECIAL RADIATION UNITS AND/OR SI-UNITS. Liden, K. (Univ., Louvain, Belg.). Health Phys.; 26: No. 6, 583-584(Jun 1974).

It is stated that following a previous letter by the author (Lidén, K., Health Phys.;25:199(1973)) concerning "SI Units in Radiology and Radiation Measurement" the ICRU received 30 written comments. In addition to these the ICRU would appreciate comments on the quantity dose equivalent H, and its unit 1 rem. All such comments will be considered by the ICRU at their meeting in July 1974. (UK)

11682 RADIOGRAPHIC EXPOSURE CALCULATOR. Horsington, G. (Nevill Hall Hospital, Abergavenny, Eng.). Radiography; 40: No. 472, 77-83(Apr 1974).

A slide rule is described, in kit form designed empirically to calculate exposure factors for conditions encountered in diagnostic radiography. The calculator uses the existing calibrations of x-ray equipment usually found in diagnostic departments. It can make a "basic" exposure calculation with one movement, and can be used for calculating exposure factors for a variety of conditions, various unit conversions, and compensation factors. Examples of use are given. (UK)

11683 TLD MEASUREMENTS OF DOSE DISTRIBUTION AROUND A BETA-RAY APPLICATOR. Ruden, B. I.; Bengtsson, G. (National Inst. of Radiation Protection, Stockholm). Phys. Med. Biol.; 19: No. 2, 186-195(Mar 1974).

Central axis depth dose and isodose curves around a ^{90}Sr applicator used for neurosurgery were measured in a polystyrene phantom, using LiF teflon dosemeters having the shape of discs, 1 mm in diameter and 0.1 mm thick. The minimum distance between the applicator and the dosemeters was 0.1 mm. The results were checked at a number of points using a simplified method of calculation. Agreement within experimental error was obtained between theoretical and experimental results at source-detector distances of 2 to 5 mm. At smaller distances the approximations involved resulted in too high theoretical values. At larger distances the consistency was again poorer. The measured values of absorbed dose have experimental errors of a few percent. (auth)

11684 DOSIMETRIC UNITS. Rindi, A.; Thomas, R. H. (Univ. of California, Berkeley). G. Fis. Sanit. Prot. Radiaz.; 16: No. 4, 177-183(1972). (In Italian).

The historical reasons for the adoption of the present dosimetric units are outlined. The units are then analyzed individually to show that a more practical method is available, in the present state of knowledge, for an evaluation of the dangers in a radiation field, especially around high energy accelerators but also around more conventional radiation sources. (tr-auth)

11685 MULTIPLE SCATTER CORRECTIONS BELOW 0.1 MeV. Hubbard, L. B. (Furman Univ., Greenville, SC). Phys. Med. Biol.; 19: No. 2, 221-223(Mar 1974).

Comment is made on a method of calculating the contribution to the absorbed fraction from multiply scattered γ-rays (Hubbard, L. B., and Williamson, F. S., Physics. Med. Biol., 16, 35, (1971)). The method worked well for those energies for which the interaction is almost entirely Compton Scattering. It is pointed out that at lower energies the photoelectric effect becomes important, and an assumption that every photon interaction produces a scattered photon leads to an overestimate of the number of photons each with too low an energy. It is demonstrated that a previously proposed model will continue to work well at lower energies ($E \leq 0.1$ MeV) if the computed Compton attenuation and absorption coefficient are used rather than the total coefficients. When the first collision term is dominant in the total absorbed fraction, the modified model fits to within a few of the results of Monte Carlo calculations. When this is not the case (in the range 30 to 80 keV), the new model has deviations of up to 10%. (UK)

11686 RADIOLOGICAL PROTECTION AND NUCLEAR POWER. Windeyer, B. (National Radiological Protection Board, Sutton, Eng.). J. Inst. Nucl. Eng.; 15: No. 2, 35-45(Mar 1974).

From joint meeting of the Institution of Nuclear Engineers with the British Nuclear Energy Society; London, England (27 Nov 1973).

A review is presented on the subject of radiological protection in relation to the nuclear power programme. Aspects covered include organization for protection; philosophy of radiological protection; specific problems of nuclear power; problems in operation of reactors; problems in fuel manufacture and processing; and gaseous, liquid, and soid wastes. (UK)

11687 FIRST LATIN AMERICAN CONFERENCE ON PHYSICS IN MEDICINE AND RADIATION PROTECTION, SAO PAULO BRAZIL, FEBRUARY 28–MARCH 3, 1972. Sao Paulo, Brazil; February 28–March 3, 1972. Sao Paulo, Brazil; Instituto de Energia Atomica (1972). 343p. (CONF-720233-).

Separate abstracts were prepared for the 23 papers presented in this volume of the proceedings. An abstract of one additional

paper on x ray and electron beam characteristics from a 25 MeV linear accelerator is included. (ERB)

For abstracts of individual papers see: 9592, 9593, 9606–9610, 9838, 10207–10209, 10314, 10518, 10519, 11688–11695, and 11701.

11688 SOME PROBLEMS IN CLINICAL RADIATION DOSIMETRY. Oliver, R. (Hammersmith Hospital, London). pp 37-60 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

The first stage of clinical dosimetry is the provision of accurate standards. Water phantom depth dose tables and isodose curves are now available and corrections for irregularity of the body surface or for tissue heterogeneity can be allowed for or compensation can be used to maintain the standard dose distributions. The need is stressed for uniformity in the statement of dose and its variation throughout the tumor, and in the description of the regime in terms of overall time and number of fractions. Good dosimetry is essential to the optimization and intercomparison of the results of radiotherapy. (auth)

11689 IRRADIATION USING WEDGE FILTERS WITH COBALT-60 AND LINEAR ACCELERATORS. Pereira, A. J.; Morales, F. C. (Hospital A. C. Camargo, Sao Paulo, Brazil). pp 63-68 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American Conference on Physics in Medicine and Radiation Protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

The use of lead wedge filters for shaping the radiation fields from linacs and ^{60}Co sources for radiotherapy is discussed. (WDK)

11690 NEW DEVELOPMENTS IN THE PHYSICS OF DIAGNOSTIC RADIOLOGY. Cameron, J. R.; Moran, P. R. (Univ. of Wisconsin, Madison). pp 69-78 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

New developments in diagnostic radiology are considered in the following categories: the x-ray generator, the detector system, the information handling system, and the development of new diagnostic tests resulting from any combination of the three previous areas. (MHR)

11691 REDUCTION OF RADIATION DOSE TO THE PATIENT IN DIAGNOSTIC RADIOLOGY. Cameron, J. R. (Univ. of Wisconsin, Madison). pp 92-98 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

In the U.S. the major health physics problem is the reduction of radiation to the public from diagnostic x-rays. Three general approaches to the solution are suggested: (1) There is a great need for better education in regard to health physics aspects of diagnostic x-rays for all technicians and physicians using x-ray equipment. (2) Legislation can (i) assure that the operators and physicians in charge of x-ray units have the necessary education and (ii) also to make sure that the units meet minimum standard of safety to the patient and the operator. (3) There is a pressing need for applied research in diagnostic radiology. (auth)

11692 PATIENT DOSE IN RADIOLOGY. Oliver, R. (Hammersmith Hospital, London). pp 99-114 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

The Adrian Survey reported an average annual gonad dose from radiology in the U. K. of 14 mrads, but indicated that this could be reduced by the use of shielding and the limitation of field size. Special problems of patient dose are discussed relating to the use of intra-oral tubes and of high tube currents when image intensifiers are provided with automatic brightness control. The use of R-cm^2 units is recommended for recording patient exposure. (auth)

11693 RADIATION DOSES OF PERSONNEL WORKING IN NUCLEAR MEDICINE AT RECIFE, BRAZIL. Berreira, J. L.; Hazin, C. A.; Ribeiro, F. A. (Federal Univ. of Pernambuco, Recife, Brazil). pp 137-149 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

The analysis of personnel monitoring is made by comparing the results among four distinct groups of persons working in Nuclear Medicine at Recife, during the year of 1971: radiotherapists and technicians working in Curietherapy, radiotherapists and technicians operating only with external irradiators (teletherapy), radiologists and their technicians, and at last the specialized personnel working in isotope therapy. Another analysis is made inside each group, by dividing the personnel into their respective functional categories (physicians and technicians) and calculating the monthly average dose per man in each subgroup and after in the whole group of monitored personnel. Some considerations are made about the global results from the point of view of radioprotection, by classifying the groups and determining the cases where the maximum permissible doses were exceeded. (auth)

11694 COMPUTERS IN RADIOTHERAPY. Almond, P. R.; Stovall, M. (Univ. of Texas, Houston). pp 230-242 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

The use of computers in radiotherapy will be reviewed and the various means of computing dose distribution will be discussed for both external beam and interstitial and intracavitary treatments. Examples of treatment plans will be shown. A discussion will also be given of small dedicated computer systems for radiotherapy as well as a system for machine monitor and patient recordkeeping. An analysis will also be given of computer costs. (auth)

11695 UTILIZATION OF IBM-1130 COMPUTER IN MAPPING ISODOSE CURVES IN MULTIFIELD TECHNIQUES. Ribeiro, F. A.; Roesler, I. C.; Candeias, Z. E.; Silva, H. D. (Hospital de Cancer, Pernambuco, Brazil). pp 243-260 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Vrazil; Instituto de Energia Atomica (1972).

From first Latin American conference on Physics in Medicine and Radiation Protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

Isodose charts were plotted by the computer with two and four parallel opposed fields, different antero-posterior diameters and separation of the fields, and different dose ratios. To simplify the initial calculus with the IBM-1130 computer, a table of similar doses was used. (MHR)

11696 DOSIMETRY STUDIES OF A 25MV X-RAY BEAM. Marinello, G. (Hopital Henri-Mondor, Creteil, France); Dutreix, A. J. Radiol., Electrol., Med. Nucl.; 54: No. 12, 951-958(Dec 1973). (In French).

The dosimetry characteristics of the 25-MeV Sagittaire Accelerator (CSF) are presented. The quality of the beam is expressed in terms of the attenuation of a narrow beam in several reference materials. A curve representing the variations in dose rate with the collimator aperture is given for both square and rectangular apertures. Studies of the variations in the dose in the transition region demonstrated the variations in the skin dose and maximum depth with the distance from the source and the size of the field. Depth dose curves are presented for different source-skin distances and field sizes. The measurements made show that the effect of the beam size on the depth dose is not entirely negligible at this energy. The corrections necessary to take the obliquity of the incident beam and the heterogeneities into account are studied. Two examples of isodose curves are given, one for a single beam and the other for several combined beams. Dose measurements corresponding to the transmission through lead shielding and the scatter behind it are presented for beams of large cross sections. (FR)

11697 HYPERFINE INTERACTIONS IN HIGHLY IONIZED ATOMS. Goldring, G. (The Weizmann Institute of Science, Rehovoth, Israel). pp 178-196 of Nuclear Structure Physics. Smilansky, U. (Ed.). Berlin; Springer-Verlag (1973).

From Minerva symposium on physics; Rehovoth, Israel (2 Apr 1973). See CONF-730450-.

A state-of-the-art survey of the magnetic interaction between nuclei in excited states and atoms that are ionized in passage through matter is presented. A plausibility argument is given as to how and why the various observed patterns of ionization occur.

Relevant experimental evidence is also presented. (16 figures, 1 table) (RWR)

Radiation Protection Standards

11698 (BNL-18886) UNCHANGING ASPECTS OF RADIATION EXPOSURE LIMITS. Meinhold, C. B. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 17p. (CONF-740529-1; SM-184-19). Dep. NTIS $4.00.

From seminar on radiological safety evaluation of population doses and application of radiological safety standards to man and the environment; Portoroz, Yugoslavia (20 May 1974).

Beginning with the introduction of the first formal recommendation on radiation protection practices, a series of revisions in recommended standards has occurred. A review of the influences and pressures on the scientific community as a whole, and therefore, on the standards setters is presented to provide some valuable insight into the standard-setting process. The introduction of the hot cathode x-ray tube coupled with the public outcry over the battlefield x-ray casualities during World War I provided the needed impetus for the formal adoption of the first standard. In the mid-1920's Mutscheller developed the recommendation of $^1/_{100}$th of the erythema dose in 30 days. This led directly to the first internationally accepted limit of .2 R/day and later to .1 R/day. Even the 1950 limit of 300 mrem/week for organs at 5 cm in tissue and 600 mrem/week limit for skin had a strong basis in the original Mutscheller work. By the late 1950's the public and scientific debate over the fallout controversy ultimately led to a review of the available radiobiological data by the National Academy of Sciences in the U. S. and the Medical Research Council in Great Britain. The reports of these committees led the ICRP and the NCRP to the present limits of 5(Age −18)rem for certain critical tissues and 15 rem/year for others. Since 15 rem/year is 300 mrem/week, the tie was 1925 is intact. Today the scientific and public debate is over nuclear power plant effluents. Again, as in the 50's the National Academy of Sciences initiated a review of the available radiobiological data. Concurrently the United Nations Scientific Committee on the Effects of Atomic Radiation performed a similar study. Both reviews were published in 1972. By early 1974 the NCRP had not changed its basic recommendations. The ICRP, after an extensive review, issued a press release in 1972 stating that no changes in the radiation protection standards are warranted. (auth)

11699 (INIS-mf-987, pp 5.1-5.30) PRESENT AND POSSIBLE FUTURE RADIATION PROTECTION STANDARDS FOR URANIUM MINING AND MILLING. Stevens, D. J.; Leith, I. S. (Commonwealth Radiation Lab., Melbourne). 1972.

ICRP recommendations are discussed as well as the protection standards adopted by the USA and Australia. Safety standards such as maximum permissible doses and dose limits are described as well as the legal aspects of enforcing them. In particular the effect of radon 222 and its daughter products is described and future protection standards are recommended. (RL)

11700 SPECIFICATION OF UNITS FOR NATURAL URANIUM AND NATURAL THORIUM. Ney, W. R. (National Council on Radiation Protection and Measurements, Washington, DC). Radiology; 111: No. 1, 233-234(Apr 1974).

Feeling that the use of the special curie for natural uranium and thorium has led to confusion, the NCRP recommends that this unit be replaced by units of mass. Previously stated values of the maximum permissible body burden (MPBB) and maximum permissible concentration in air and water (MPC) for uranium may be converted to mass units by multiplying them by 3×10^8 μg per special microcurie. Since the isotopic composition of natural thorium is not constant, the NCRP recommends that established MPBB and MPC values for each individual isotope be used instead of defining a limiting concentration for all natural thorium. (auth)

11701 PROPOSED UNIT FOR PATIENT RADIATION EXPOSURE FROM DIAGNOSTIC X-RAYS. Cameron, J. R. (Univ. of Wisconsin, Madison). pp 115-120 of First Latin American Conference on Physics in Medicine and Radiation Protection. Sao Paulo, Brazil; Instituto de Energia Atomica (1972).

From first Latin American conference on physics in medicine and radiation protection; Sao Paulo, Brazil (28 Feb 1972). See CONF-720233-.

A unit for exposure-area-product is proposed: the rap (Roentgen-Area-Product) is defined as 100 R cm^2. The rap is a convenient sized unit for most diagnostic x-ray procedures. The rap and its associated measuring device, the rapmeter, would be especially useful for radiologic technologists and radiologists in measuring radiation to the patients and in answering patient's questions in regard to radiation. Measurement of the radiation in diagnostic x-ray procedures in roentgens, rads or gram-rads is not practical and is either misleading or impossible to obtain. The exposure-area-product can be measured directly by a transmission ionization chamber without any contact with the patient. It would be especially useful to measure the exposure-area-product to the patient during fluoroscopic procedures using a rapmeter. The rapmeter will be useful in quality control of diagnostic x-ray equipment and x-ray technologists. (auth)

Radiation Source Calibration and Standardization

Refer also to abstract 9794.

11702 NUCLEAR PHYSICS MEASUREMENTS ON A KILOCURIE ^{60}Co-SOURCE. Visser, C. J. Stellenbosch, S. Afr.; Stellenbosch Univ. (1972). 98p. (In Afrikaans). Atomic Energy Board, Pretoria.

Thesis.

The major part of this thesis is devoted to a study of the energy spectrum of a 5000 Ci ^{60}Co source of finite dimensions. Measurements of the exposure dose distribution at various distances from the source have also been performed. The determination of mean lifetimes of nuclear states utilizing nuclear resonance fluorescence techniques and the ^{60}Co source, is also included. This parameter is an important one in the calculation of the shape and intensity of the emitted ^{60}Co spectrum. (auth)

Shielding Calculations and Experiments

Refer also to abstracts 10530, 11839, and 11871.

11703 (AD-765488) FORTRAN PROGRAMS AND SUBPROGRAMS FOR THE IMPLEMENTATION OF THE THREE-STEP PROCEDURE AND TWO OF ITS ALTERNATIVES. Final Report. Robinson, J. C.; Slater, C. O. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). Mar 1973. Contract DAAD05-71-C-0150. 112p. (NEUT-150-5; BRL-CR-99). NTIS $4.25.

The three-step procedure and three alternatives were presented in BRL Contract Report No. 63 NEUT 0150-4 as methods for solving the type of problems presented in that report. Here a description and a listing of each of the programs and subprograms used in the implementation of the three-step procedure and its alternatives are provided. In addition, the required input is listed. (auth)

11704 (AD-771126) EXPERIMENTAL STUDIES OF THE NEUTRON AND GAMMA SHIELDING PROVIDED BY FIELD FORTIFICATIONS FROM A 14-MeV NEUTRON SOURCE. Rexroad, R. E.; Jacobson, J. R. (Ballistic Research Labs., Aberdeen Proving Ground, Md. (USA)). Oct 1973. 93p. (BRL-1681). NTIS $3.75.

An experiment was conducted to determine the attenuation of high energy (about 14-MeV) neutrons and secondary gamma photons by open and covered field fortifications (which were represented by open and covered cylindrical holes in the ground). Neutron spectrum and dose and gamma exposure were measured as a function of distance between the source and the hole and thickness of cover over the hole. (GRA)

11705 (AD-771324) INITIAL GAMMA RADIATION DOSE IN FIVE CONCRETE STRUCTURES. Final Report. Beer, M; Cohen, M. O. (Mathematical Applications Group, Inc., Elmsford, N. Y. (USA)). Nov 1973. Contract DAHC20-73-C-0201. 37p. (MR-7037). NTIS $3.00.

A method has been developed for calculating initial radiation doses, in buildings with complex geometry, due to secondary gamma rays and fission product gamma rays emanating from an elevated ring source. It uses the adjoint Monte Carlo code SAM-A to compute adjoint currents which may be stored and subsequently coupled with different source flux distributions. The doses at an extensive number of detector points within five different concrete blockhouse benchmark structures have been computed. (auth)

11706 (LA-UR-74-600) APPLICATION OF SHIELDING BENCHMARK EXPERIMENTS TO THE TESTING OF NUCLEAR DATA, CALCULATIONAL METHODS, AND PROCEDURES. LaBauve, R. J.; Harris, D. R.; Muir, D. W.; Hemmig, P. B. (Los Alamos Scientific Lab., N. Mex. (USA); USAEC, Washington, D. C.). 1974. Contract W-7405-eng-36. 26p. (CONF-740440-1). Dep. NTIS $4.50.

From specialist meeting on integral shielding experiments; Ispra, Italy (17 Apr 1974).

A number of experiments have been conducted in the United States which have served as benchmarks for the testing of nuclear data important in shielding applications and in the validation of shielding calculational methods and procedures. Over the past several years, a cooperative program among U. S. governmental and industrial laboratories has been developed for the purpose of providing a data base for general use in nuclear calculations. This work has been coordinated through the Cross Section Evaluation Working Group (CSEWG) administered by Brookhaven National Laboratory and has resulted in the publication of several versions of an Evaluated Nuclear Data File (ENDF/B). The number of nuclides included in the file, the amount and accuracy of data given for a particular nuclide, and the types of data given for a particular nuclide have been greatly expanded from version to version of ENDF/B. To give an example of particular interest to the shielding community, the most recent version will contain 37 nuclides for which complete gamma-ray production data will be provided. The testing and validation of the ENDF/B data is done within the CSEWG by calculating a selected group of benchmark experiments, each of which provides insight to a particular aspect of the data. Although these benchmarks are specifically selected for data testing, they also serve the useful purpose of validating the data processing codes and the calculational design codes. Existing shielding experiments are continually being identified as being suitable for benchmarks, and new experiments are being planned specifically for data and calculational code testing. (auth)

11707 (ORNL-tr-1658) SHIELDING EXPERIMENTS IN THE GEESTHACHT RESEARCH REACTOR. Annual Report, 1965. Bagge, E.; Fischer, E. (Commission of the European Communities, Brussels (Belgium); Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Hamburg (F.R. Germany)). [nd]. Translation of EUR-2960. 197p. Dep. NTIS $13.00.

The shielding experiments which were started under the contract between the European Atomic Community (EURATOM) and the Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH (GKSS), effective as of January 1, 1961, were continued in 1965. The experimental facilities "ESTAKOS," "ESTAGROP I", and the large radiation channel in the FRG [Geesthacht Research Reactor] with the "ESTAGROP II", which have been described in the annual reports of the shielding group of 1962 (EUR 534.d) and 1964 (EUR 2494.d) were available for the studies. A special study group developed and tested a part of the instruments and equipment used in the experiments and was occupied with the further development of methods for the measurement of neutron and gamma-spectra. Parallel to the experiments, the group of theoreticians continued their work on the calculation of the shielding effects of configurations at the FDR. (auth)

11708 RADIATION SHIELDING DESIGN FOR IRRADIATION FACILITIES. Monte Carlo Simulation in Gamma Photon Attenuation and Scattering Problems. Ito, K. (Building Research Inst., Tokyo). Kenchiku Kenkyusho Nenpo; No. 1971, 412-420 (Oct 1972). (In Japanese).

Monte Carlo simulation about gamma photon attenuation and scattering problems was performed to investigate proper method of radiation shielding. A subroutine which produced uniform random numbers within the region (0, 1) was made and used. Photo-electric effect, Compton effect, and electron-pair production were taken into account in the calculation. The procedure of tracing the behavior of the gamma photons is as follows: (1) Calculation of the linear absorption coefficient of shielding material, (2) determination of the collision point of the incident gamma photons, (3) determination of the character of the collision, that is whether it is scattering or absorption, (4) determination of scattering angle, (5) calculation of the position of the scattered gamma photons and new direction after the scattering, and (6) calculation of energy of the scattered photons. Gamma radiation from ^{60}Co was assumed as incident gamma-ray. Energy spectra of gamma radiation passing through the shielding material were obtained. Most probable energy range of the photons passing through the shield was the range between 1.20 and 1.25 MeV. A peak of the energy of back scattered gamma radiation was around 0.10 to 0.15 MeV. Energy spectra in the aluminum shield were obtained. The high energy part was prominent in singly scattered spectrum, while low energy part increased in multiple scattered spectra. Absorbed gamma radiation in the aluminum shield was about 15%. It is considered that the present simulation gives good results. (JA)

11709 METHOD FOR THE OPTIMIZATION OF A LAYERED SHADOW SHIELD. Klumpp, W. Stuttgart; Univ. Stuttgart (1972). 83p. (In German). (IKE-6-52).

Thesis.

A test is made to minimize the shield weight for nuclear reactors to be installed as power sources in satellites. A method is given for the minimization of shadow shields consisting of material layers. As optimization algorithm, dynamic programming is employed. The radiation field in the shield is calculated using a two-dimensional S(N)-method. This method is based on dose iteration with simultaneous weight reduction, requiring only a few S(N)-calculations to be performed as these need much computing time. The results of the radiation flux calculation of a shield are used to determine the dose rate of similarly constructed shields without S(N)-calculation. (GE)

PHYSICS (THEORETICAL)

General

Refer also to abstract 11116.

11710 (COO-2280-8) GLOBAL ESTIMATES FOR NONLINEAR REACTION AND DIFFUSION. Stakgold, I. (Northwestern Univ., Evanston, Ill. (USA)). May 1974. Contract AT(11-1)-2280. 15p. Dep. NTIS $4.00.

Gradient bounds and some global estimates for the solution u(x) of the nonlinear problem of combined diffusion and reaction $-\Delta u = f(u)$, $x \in D$; $\partial u/\partial \nu + hu = 0$, $x \in \partial D$ are obtained; D is a bounded domain in R_n with boundary ∂D and outward normal, Δ is the n-dimensional Laplacian, h is a positive constant, and f is such that the problem has a unique positive solution. This problem arises in a variety of applications, such as steady operation of a homogeneous monoenergetic nuclear reactor with feedback (u being the neutron density); nonlinear heating, such as Joule heating in a homogeneous medium (u being the temperature); nonlinear chemical reaction combined with diffusion in a biochemical setting (u being the concentration of a reactant). Existence and uniqueness of positive solutions, gradient bounds, norm estimates, and isoperimetric inequality for the total flux are treated. (RWR)

11711 (IA-1282) RESEARCH LABORATORIES ANNUAL REPORT, JANUARY-DECEMBER 1972. (Israel Atomic Energy Commission, Tel Aviv). Oct 1973. 254p. Dep. NTIS (US Sales Only) $15.75.

Brief summaries are presented of the research work carried out during the period January-December, 1972. This research includes mathematics and theoretical physics and chemistry, neutron and reactor physics, solid-state physics and metallurgy, nuclear physics and chemistry, high energy and radiation chemistry, physical and inorganic chemistry, analytical chemistry, application of radiation and radioisotopes, health physics and radiation safety, instrumentation and techniques, and information retrieval. (JFP)

11712 (IFVE-SPK-SVM-73-8) PATCHY SYSTEM FOR STORAGE, UPDATING, AND RUNNING OF LARGE PROGRAMS. (Manual for Users). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 32p. (In Russian). INIS.

A description is given of the PATCHY system developed for organizing, storing, modernizing, and operating large programs which as a rule exist in a number of variants and are used on various digital computers. At the Inst. of High Energy Physics (Serpukhov) and the Joint Institute of Nuclear Research (Dubna) the CERN variant of the program PATCHY has been adopted. This description of the program is based on the presently available description (CERN TC LIBRARY L^{400}) with additions and changes made during adaptation being taken into account. (SJR)

11713 (ITEF-12) INVESTIGATION OF OPERATOR f-CONTINUITY. Marchenko, E. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 26p. (In Russian). INIS.

The equivalence of f and f_1-continuity of an operator is introduced and investigated. Necessary and sufficient conditions are given for the equivalence of a given function f, a nondecreasing function f_1 or a continuous function f_1. An example is constructed of a real function of a real variable which is continuous over the whole number line, and is everywhere f-discontinuous. (SJR)

11714 (ITEF-13) PROGRAM "DISPATCHER-72" FOR RAZDAN-3 COMPUTER. Zhurkin, V. V.; Mikhailov, O. E.; Polyakova, L. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 16p. (In Russian). INIS.

A description is given of the program "DISPATCHER" developed for the "Razdan-3" digital computer, equipped with a system of interruption on 8 channels and intended for use in a system that accumulates and handles physical data. The program assures joint operation of five users. (SJR).

11715 (LA-5594-MS) RELATIVISTIC SCHROEDINGER EQUATION. Heller, L. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1974. Contract W-7405-eng-36. 8p. Dep. NTIS $4.00.

The requirements of Lorentz invariance on a system of two interacting particles are discussed in terms of the position, momentum, and spin operators of the particles. The Lippmann-Schwinger equation is written down, and shows the difference between using an invariant normalization for the states and a noninvariant one. For a spinless system, off-shell unitarity is reviewed. The relation to the Klein-Gordon equation is discussed, and also, for the equal mass case, the nonrelativistic Schrödinger equation. (auth)

11716 (UCID-16508) COMPUTATIONS IN STATISTICAL MECHANICS. Alder, B. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1974. Contract W-7405-Eng-48. 74p. Dep. NTIS $6.75.

In this series of lectures a survey is given of the enormous impact that numerical calculations have had in the field of statistical mechanics or, in other words, in the solution of the many-body problem. These calculations were made possible only through the availability of high speed digital computers and through the development of new numerical techniques uniquely suited to these computers. By these means some of the mathematical difficulties which had prevented progress in the field could be circumvented and new physical insight into the behavior of many interacting particle systems was gained. The purpose of these talks is to outline the numerical procedures without going into either excessive technical details on the computational procedures or the rigorous mathematical proofs justifying the methods used. These can be found in the references supplied. Similarly, the number of physical situations to which these numerical methods have been applied have rapidly multiplied in recent years, so that only the highlights can be presented. The topics are selected primarily on the basis of their fundamental contributions to the understanding of interesting physical phenomena and the validity of various mathematical methods to describe them, with examples. Further illustrations and more detail can again be found in the references, although that list is not intended, by any means, to be exhaustive. The intent of the lectures is to give a flavor of the contribution these numerical methods can make to statistical physics by discussing in a general way some outstanding examples. (auth)

11717 DIAGRAM TECHNIQUES IN QUANTUM OPTICS. Radiative Decay and Broadening. Stedman, G. E. (Canterbury Univ., Christchurch, New Zealand). J. Phys., A (London); 7: No. 4, L48-L51(1 Mar 1974).

What is apparently the first rigorous justification of Feynman diagram methods in quantum optics is given. As an example, single-atom radiative decay theory is generalized to all orders of perturbation of all interactions, by analogy with earlier work on phonon broadening. (auth)

11718 DUALITY OF OBSERVABLES AND GENERATORS IN CLASSICAL AND QUANTUM MECHNICS. Grgin, E.; Petersen, A. (Belfer Graduate School of Science, Yeshiva University, New York, New York 10033). J. Math. Phys. (N.Y.) 15: No. 6, 764-769 (June 1974).

In classical and in quantum mechanics physical variables play a dual role as observables and as generators of infinitesimal transformations in the invariance groups. We show that if the Lie algebra of generators is central simple, the observable-generator duality restricts the structure of the algebra of observables to two cases: a commutative, associative algebra as in classical mechanics, or a central simple special Jordan algebra as in quantum mechanics. (auth)

11719 DOES THE LIFETIME OF AN UNSTABLE SYSTEM DEPEND ON THE MEASURING APPARATUS. Degasperis, A. (International Centre for Theoretical Physics, Trieste, Italy); Fonda, L.; Ghirardi, G. C. Nuovo Cim.; 21A: No. 3, 471-484 (1 Jun 1974).

Within the description of the experimental determination of the decay law recently proposed we investigate the possibility that the experimentally determined lifetime τ be different from the theoretical lifetime $1/\gamma$ for undisturbed evolution of the unstable quantum system. It is shown that in some specific examples the deviation of τ from $1/\gamma$ is competitive with the accuracy of the experiment. It is made plausible that such a difference, together with a variation of τ with the different experimental set-ups, could be revealed by properly choosing some specific unstable systems and properly devised measuring apparatus. (auth)

11720 FREDHOLM APPROXIMANTS FOR THE LIPPMANN-SCHWINGER EQUATION. Sharma, M. L.; Bondyopadhyay, D. (Univ. of Delhi). J. Phys., A (London); 7: No. 5, L57-L60(21 Mar 1974).

A method based on Fredholm approximants is proposed for the approximate solution of the Lippmann-Schwinger equation. All diagonal Fredholm approximants constructed in this way are shown to be unitary. The method can be generalized to include Bethe-Salpeter and N/D equations. (auth)

11721 RELATIVISTIC QUANTUM THEORY OF WAVE FUNCTIONS. Caubet, J. P. (Poitiers Univ., France). Compt.

Rend., Ser. A, B; 277: No. 24, 1199-1202(17 Dec 1973). (In French).

A probabilistic interpretation of wave functions is presented in the framework of quantum relativity: the Klein-Gordon equation; relativistic spinorial equations, fermions, bosons, and the Pauli exclusion principle. (auth)

11722 COHERENT SPIN STATES. Holtz, R. (CNRS, Marseille); Hanus, J. J. Phys., A (London); 7: No. 4, L37-L40 (1 Mar 1974).

Some properties of so called coherent spin states, analogous to the coherent states of the harmonic oscillator, are discussed. Polynomials of order 2S play an important role. The representation of spin operators in the space of coherent spin states is found. This representation is used to study the rotation operator. (auth)

11723 PEDAGOGICAL ROLE AND EPISTEMOLOGICAL SIGNIFICANCE OF GROUP THEORY IN QUANTUM MECHANICS. Levy-Leblond, J. M. (Univ., Paris). Riv. Nuovo Cim.; 4: No. 1, 99-143(1974).

The discussion covers the motivations and goals, group theory and the foundations of quantum mechanics, remodelling Galilean quantum mechanics, and philosophical and ideological biases in quantum physics. (JFP)

11724 GENERALIZATION OF WEINSTEIN'S PROCEDURE FOR CALCULATING BOUNDS TO QUANTUM-MECHANICAL QUANTITIES. Cohen, M. (York Univ., Toronto); Feldmann, T. J. Phys., A (London); 7: No. 5, 563-571(21 Mar 1974).

A simple unified procedure, based on a generalization of a method first used by Weinstein (Proc. Natn. Acad. Sci. USA; 20: 529-32 (1934)) yields effective lower and upper bounds to energy levels and overlap integrals of quantum-mechanical systems. A further generalization yields bounds to expectation values. (auth)

11725 STATISTICS OF OBSERVATIONS FOR PROPER AND IMPROPER MIXTURES IN QUANTUM MECHANICS. Baracca, A. (Univ., Florence); Bergia, S.; Bigoni, R.; Cecchini, A. Riv. Nuovo Cim.; 4: No. 2, 169-188(1974).

The following situation is discussed: Let I and II denote two microscopic physical systems and I + II their combination. An attempt is made to give a quantum mechanical description of these systems in the two situations: a state vector is assigned for the system I + II and the knowledge of the system I + II is incomplete, that is, if one considers an ensemble consisting of a large number of systems of the same structure as I + II then one can only assign the weights of the various states of I + II corresponding to definite states of I and II in the ensemble. (JFP)

11726 RELEVANCE OF THE QUANTUM-MECHANICAL SPACE-TIME DESCRIPTION. Papp, E. (Polytechnic Inst., Cluj). Lett. Nuovo Cim.; 10: No. 1, 11-15(4 May 1974).

The possibility of defining a quantum-mechanical time operator by virture of the correspondence principle is considered. In addition, some other formulations supporting the program of the quantum-mechanical space-time description are investigated. (LBS)

11727 OPERATOR PRODUCT EXPANSIONS. Zimmermann, W. (New York Univ., NY). pp 343-363 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

Lectures are given on a review of some recent work on operator product expansions. The behavior of the operator product $A_1(X_1)A_2(X_2)$ of two field operators near the origin $(x_1 - x_2)^2 \to 0$ is studied. (JFP)

11728 THEORY OF ACTION-AT-A-DISTANCE IN RELATIVISTIC PARTICLE DYNAMICS. A Reprint Collection. Kerner, E. H. (ed.). International Science Review Series, Volume XI. New York; Gordon and Breach, Science Publishers, Inc. (1972). 228p. $14.85.

This collection of 17 reprints draws together recent relativistic treatments of the theory of action at a distance and covers such topics as particle interactions, absorbers, radiation mechanism, classical electrodynamics, point particle interactions, conservation laws, relativistic dynamics, relativistic invariance, Hamiltonian theories, no-interaction theories, position variables, Poincare-invariant equations of motion, relativistic particle orbits, and the inhomogeneous Lorentz group. (JFP)

11729 EXTENSION OF DIRAC'S POSITIVE-ENERGY WAVE EQUATION. Photinos, D. J.; Moroi, D. S. (Kent State Univ., OH). Lett. Nuovo Cim.; 10: No. 1, 28-32(4 May 1974).

An extension is made of Dirac's new equation involving four internal variables satisfying the given commutation relations. (JFP)

11730 CALCULATION OF THE AVERAGES FOR PHYSICAL VALUES BY THE QUANTUM FUNCTION OF THE WIGNER DISTRIBUTION. Gorshenkov, V. N.; Kon'kov, V. L. (Gorky Scientific-Research Physical-Technical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 140-141(1973). (In Russian).

An analysis is made of the formulas for the calculation of averages for physical values by the quantum function of the Wigner distribution. The analysis showed that the correspondence principle appears inconsistent. The assumption that must be made for the formulas to give single-valued and accurate values is derived. (JSR)

11731 NEW PRECISE SOLUTION OF THE DIRAC EQUATION I. Bagrov, V. G.; Klimenko, Yu. I.; Shapovalov, V. N.; Shakhmatov, V. M.; Ekle, G. G. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 7, 95-101(1973). (In Russian).

Three new types of external electromagnetic fields permitting a precise solution of the Dirac and Klein-Gordan equations were found. The wave functions are expressed by quadratures. The solutions corresponding to the classical relativistic motion equation were also found. (tr-auth)

11732 EQUATIONS FOR THE HIGHER LEGENDRE TRANSFORMATIONS IN TERMS OF 1-IRREDUCIBLE VERTICES. Vasil'ev, A. N.; Kazanskii, A. K.; Pis'mak, Yu. M. (Leningrad State Univ.). Teor. Mat. Fiz.; 19: No. 2, 186-200(May 1974). (In Russian).

Equations for the functional Legendre transformations of arbitrary order are deduced, in which the 1-irreducible (and not simply connected) vertices are considered as independent variables. The iterative solution of the equations is represented by means of the skeleton graphs, the vertices of which are the 1-irreducible diagrams with n external lines. As a result, any vertex with n external lines can be represented as the sum of the "bare" vertex and the skeleton graphs of the type mentioned. (auth)

11733 VALIDITY OF THE QUASI-CLASSICAL APPROXIMATION. Elyutin, P. V.; Krivchenkov, V. D. (Moscow State Univ.). Teor. Mat. Fiz.; 19: No. 2, 233-236(May 1974). (In Russian).

A study is made of whether the quasiclassical approximation can be applied for evaluating the discrete spectrum of the Schrödinger equation. It is shown that for the potentials, which are not of the power type, there exists the dimensionless parameter, the smallness of which guarantees that the quasiclassical spectrum is close to the exact one at small n. (auth)

Quantum Field Theories

Refer also to abstracts 11049, 11102, 11104, 11112, 11124, 11172, 11183, and 11267.

11734 (DESY-74-8) SIGNIFICANCE OF CONFORMAL INVERSION IN QUANTUM FIELD THEORY. Koller, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Mar 1974. 30p. Dep. NTIS (US Sales Only) $4.50.

The 2-point functions of Euclidean conformal invariant quantum field theory are looked at as intertwining kernels of the conformal group. In this analysis a fundamental role is played by a two-element group W, whose nonidentity element R = R·I consists of the conformal inversion R multiplied by a space-time reflection I. The propagators of conformal invariant quantum field theory are determined by the requirement of R-covariance. The importance of the R-inversion in the theory of Zeta-functions is mentioned. (auth)

11735 (IFVE-STF-73-23) SINGLE-TIME EQUATION FOR PARTICLE SCATTERING ON BOUND STATE IN QUANTUM FIELD THEORY. Arkhipov, A. A.; Savrin, V. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov, Inst. Fiziki Vysokikh Ehnergij). 1973. 27p. (In Russian). INIS.

The study shows how a single-time formulation of the relativistic problem of many bodies leads to a quasipotential equation for scattering of two particles, one of which is a bound state of two other particles. The effective potential of this interaction is expressed through the quasipotentials of a pair interaction, and also a quasipotential which is not reduced to pair potentials. (SJR)

11736 (IFVE-STF-73-43) AXIOMATIC METHOD IN QUANTUM ELECTRODYNAMICS. Solov'ev, L. D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 21p. (In Russian). INIS.

A method is considered for the theory of electromagnetic interaction that is free of infrared divergences. The method is based

on the use of Bogolyubov's equations (axiomatic approach) in quantum field theory, in which the infrared divergences are removed. A discussion is given on the exact consequences of these equations—low-energy theorems and dispersion relations over all orders from the electromagnetic interaction. All model-independent members of the infrared asymptotic of Green's function are presented for a charged spinless particle. (SJR)

11737 (INIS-mf-1321, pp 1-82, Pt. 5) SCALING LAWS AND SCALE INVARIANCE IN THE THEORY OF PHASE TRANISTIONS AND IN RELATIVISTIC QUANTUM FIELD THEORY. Schroer, B. (Freie Univ., Berlin). 1972.

During recent years there has been a parallel development of ideas on scaling, scale and conformal invariance in the area of relativistic quantum field theory and the theory of phase transition. An attempt is made to review and analyze the parallel development in both fields. Analogies and differences between the two fields are discussed. The main emphasis is placed on the structural properties of scale- and conformal-invariance theories. (auth)

11738 (JINR-E2-7725) GENERALIZATION OF THE IRREDUCIBLE COEFFICIENT FUNCTIONS METHOD TO THE CASE OF FERMI PARTICLES: YUKAWA MODEL IN TWO-DIMENSIONAL SPACE-TIME. Zastavenko, L. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

Previously developed methods are generalized to the case of Fermi particles. The constructions of ground state functional and excited state functional are given analogously with the boson case. Equations for coefficient functions of ground state functional are derived; they are the Yukawa equivalent of $g\phi^4$. Equations are rewritten in dimensionless variables; this step is useful for the investigation of strong coupling limit. One does not succeed, however, unlike $g\phi^4$ model in receiving strong coupling decomposition. The construction of asymptotic states is given, so that the scattering problem is reduced to that of solving Ekstein equations. The transformation is given which turns the Tamm-Dankoff equations into equations of the given method. (auth)

11739 (JINR-E2-7788) TAU-FUNCTIONS OF A SCALAR FIELD IN TERMS OF THE RELATIVISTIC WIENER PSEUDO-PROCESS. Garczynski, W. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

The applications of the relativistic Wiener pseudoprocess to the construction of the τ-functions of a scalar quantum field are considered. The construction goes parallelly to the known Ginibre's and Symanzik's work on the Euclidean quantum field theory with exchanging the Wiener process on a corresponding relativistic pseudoprocess. More general interaction Lagrangians are considered than those by mentioned authors. (auth)

11740 (JINR-E2-7790) EIKONAL APPROXIMATION FOR HIGH ENERGY INCLUSIVE PROCESSES. Barbashov, B. M.; Nesterenko, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

An attempt is made to use the eikonal approximation for studying the inclusive reactions within the framework of quantum field model, $L_{int} = -ig\psi^* \overleftrightarrow{\partial_\mu} \psi A^\mu$. The inclusive cross section thus obtained appears to be dependent only upon $q_\perp^2$ both in the fragmentation and pionization regions. (auth)

11741 (JINR-E2-7805) ON THE RELATIVISTIC LENGTH. Streltsov, V. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

The concept of relativistic length is discussed. The definition is based on the measuring procedure with the direct use of a clock and light signals(analogous to the radar method). A consequence of the indicated definition is an increase of longitudinal dimensions of fast-moving objects. It should be noted that the concept of relativistic length introduced in this way is in logical accord with the doctrine of distance utilized in relativistic electrodynamics. It is emphasized that the asynchronous formulation of Cavalleri and Salgarelli and true transformations of Rohrlich are physically meaningful only in the framework of the present concept. (auth)

11742 (JINR-E2-7864) HIGH-ENERGY PROCESSES IN SCALE INVARIANT QUARK MODEL. Efremov, A. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

Within the framework of field theory of quarks, interacting with a scalar (or pseudoscalar) field, a series of hadron processes are considered, employing the consequences of the short distance scale invariance (SDSI) hypothesis for the on-mass-shell processes. A weak bare quark interaction is required for theoretical results to be consistent with experiment on large-q^2 nucleon electromagnetic form factor, high energy large-angle elastic pp-scattering, large-$q_\perp$ pion inclusive production, and deep inelastic ep-scattering. A number of predictions are formulated concerning analogous processes with other particles. A possibility for experimental check of the SDSI hypothesis is discussed, as well. (auth)

11743 BILOCAL SCALE-INVARIANT FIELD THEORY FOR MASSIVE PARTICLES. Roman, P.; Lorente, M.; Huddleston, P. L. (Boston Univ.). Nuovo Cim.; 21A: No. 3, 592-610(1 Jun 1974).

A recently proposed algebraic model for relativistic hadrons that contains dilatations in an interesting substructure is realized in terms of differential operators acting on a bilocal field. Wave equations are found for both 0 and $\frac{1}{2}$ spin. It is shown that, in spite of dilatation invariance, particles can have nonvanishing rest mass. This result is a consequence of having multicomponent wave functions, where the components belong to different values of the dilatation quantum number. A canonical formalism is developed and the currents, related to various symmetries, are computed. It is possible to represent the currents of interest as various first moments of two energy-momentum tensors. (auth)

11744 STRENGTHENED NO-GO THEOREM FOR FERMI FIELDS OBEYING CAR. Driessler, W. (Univ. of Bielefeld, Ger.). Nuovo Cim.; 21A: No. 3, 583-591(1 Jun 1974).

A generalization of the ICAR theorem of Powers is proved without using any invariance properties, and then it is shown that the assumptions of that theorem in fact yield a canonical form for the field equation. (auth)

11745 ON STRESS-ENERGY TENSORS. Goedecke, G.H. (New Mexico State University, Las Cruces, New Mexico 88003). J. Math. Phys. (N.Y.) 15: No. 6, 792-794 (June 1974).

An old but not well-known formal method is detailed and used to obtain the symmetrized stress-energy tensor from Noether's theorem applied to Poincaré-covariant Lagrangian field theories. A variation in a standard method is presented and used to obtain the corresponding canonical stress-energy tensor, valid in arbitrary curvilinear coordinates, in the limit of Lorentz metric. These two tensors are shown to be equal, in each case, for scalar, Maxwell, Dirac spinor, coupled Maxwell-Dirac, and vector (non-Maxwell) Lagrangian field theories. (auth)

11746 HIGHER-ORDER DIAGRAMS IN QUANTUM GRAVITY AND THE CONTINUOUS DIMENSION METHOD. Capper, D.M. (International Centre for Theoretical Physics, Trieste, Italy); Leibbrandt, G. J. Math. Phys. (N.Y.) 15: No. 6, 795-797 (June 1974).

The following three third-order Feynman diagrams in quantum gravity are treated in the context of dimensional regularization: (a) the pure graviton triangle diagram and (b) two massless tadpole diagrams. It is shown that the graviton vertex integral is free of ultraviolet and infrared divergences as we approach Minkowski space ($\omega=2$). It is also shown that the ultraviolet divergences arising from two-loop massless tadpole integrals either vanish completely as $\omega \to 2$, or manifest themselves as poles of Weierstrass' gamma function. (auth)

11747 A NEW METHOD FOR THE STUDY OF FEYNMAN PERTURBATION SERIES. Kershaw, D.S. (Center for Theoretical Physics, Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). J. Math. Phys. (N.Y.) 15: No. 6, 798-807 (June 1974).

We have systematically studied a finite-dimensional version of Feynman perturbation series with arbitrary matrices for propagators and arbitrary tensors for interaction couplings. In this formalism we obtain many old results in an elegant new manner, and we obtain a completely new fundamental integral representation for the Green's functions of boson field theories which rigorously defines these functions in our finite-dimensional version and which we hope will enable us to calculate the Green's functions in the physically important infinite-dimensional case. (auth)

11748 POSSIBLE OBSERVATION OF TACHYONS ASSOCIATED WITH EXTENSIVE AIR SHOWERS. Clay, R. W.; Crouch, P. C. (Adelaide Univ., Australia). Nature (London); 248: No. 5443, 28-30(1 Mar 1974).

It is stated that so far no positive evidence was obtained for the existence of tachyons in searches made using laboratory particles or high energy cosmic rays, but the present communication reports apparently positive results from a search for tachyons associated with cosmic ray showers of energy $\sim 2 \times 10^{15}$ eV. Most of the particles in an extensive air shower (EAS) arrive at sea level with a time spread of only a few n sec., and if any shower particles are produced with velocities greater than that of light they should be observable in the time interval up to 60 μsec. before arrival of the shower front. An experiment is described that was designed to search for particles arriving within

this time period. A plastic scintillator was used to detect the particles. It is not clear what interactions a tachyon might have with the scintillator, but detection might be accomplished by direct interaction or through the production of secondary particles that interact with the detector. The chief experimental difficulty was that if a recording device is triggered by the arrival of an EAS it will be too late to observe the tachyon unless signal delays are incorporated, but this was overcome by the use of a digital transient recorder. The output was to a chart recorder after digital to analogue conversion. The air shower array at the Buckland Park field station of the University of Adelaide was used for the observations, and the mean shower rate was one per 500 sec. Data from a total of about 1307 showers, detected between February and August 1973, were analyzed, the aim of the analysis being whether or not nonrandom effects were observable immediately preceding an EAS. The technique adopted had the advantage that spurious pickup in the electronics was most unlikely to effect results. It may be possible to explain the results without invoking the existence of tachyons, but nonrandom events preceding the arrival of an EAS were observed, and being unable to explain this in a more conventional way it is suggested that this was due to particles travelling with an apparent velocity greater than light. (UK)

11749 RENORMALIZABLE THEORY OF MASSIVE VECTOR PARTICLES. Fradkin, E. S.; Tyutin, I. V. (Lebedev Inst. of Physics, Moscow). Riv. Nuovo Cim.; 4: No. 1, 1-78(1974).

An attempt is made to uniformly describe the main ideas and the results of the modern formulation of renormalizable gauge theories of massive vector fields and their application to the formulation of renormalizable gauge theories of massive vector fields and their application to the formulation of universal interaction theories. The main results are presented qualitatively. In formulating the new class of renormalizable theories spontaneous symmetry-breaking plays an important role. (JFP)

11750 DIMENSIONAL REGULARIZATION AND INFRARED DIVERGENCE. Ahmed, K.; Qadir, A. (Univ., Islamabad, India). Lett. Nuovo Cim.; 10: No. 2, 63-66(11 May 1974).

The problem of infrared divergence in ν-dimensional quantum electrodynamics is re-examined. The need for first taking a finite photon mass, μ, and then passing to the limit $\mu \to 0$ is demonstrated. (LBS)

11751 MASSIVE GAUGE THEORIES AND THE PHOTON. Gottlieb, H. P. W. (Univ. of Adelaide). Nucl. Phys.; B73: No. 2, 257-268(1974).

A model containing the massless photon as well as other massive vector mesons is constructed from a gauge-invariant theory of massless vector mesons with scalars transforming under a mixed linear-non-linear group realization, so that one massive scalar also remains finally. A Georgi-Glashow-type Lagrangian in the unitary gauge can be induced by appropriate choice of non-minimal gauge-invariant interactions in the ancestor Lagrangian. It is thus likely that this ancestor Lagrangian, which is non-polynomial, is also renormalizable. (auth)

11752 GRAPHS AND THE QUANTIZATION OF THE GEL'-FAND-YAGLOM EQUATIONS FOR HIGHER SPIN. Cox, W. (Liverpool Polytechnic). J. Phys., B (London); 7: No. 6, 665-680 (11 Apr 1974).

Further details are given of a graphical approach to the Gel'-fand-Yaglom equations and their quantization, in the case when repeated representations are not allowed. Graphs associated with the s blocks of L_0 are used in their construction, in writing down their characteristic polynomials and the traces required in the quantization conditions. As well as being useful as practical procedures, the methods described are more suggestive theoretically than the conventional algebraic treatment. As examples a range of quantizable spin-2 theories are obtained. In particular it is shown that it is possible to obtain various mass spectra and yet still have a quantizable theory. Such multi-mass theories have only been obtained previously using repeated representations. Also it is proved that the representation $(-1,j+1) + (0,j+1) + (1,j+1)$ must occur in a good quantizable theory with maximum spin $j \neq 0$. Although only integer spin is considered here, the modifications for half-odd integer spin are straightforward. (auth)

11753 ASTROPHYSICS AND TACHYONS. Mignani, R.; Recami, E. (Univ., Catania, Italy). Nuovo Cim.; 21B: No. 1, 210-226(11 May 1974).

From the very special relativity theory, the existence of superluminal reference frames and faster-than-light objects can be inferred, when its validity is not arbitrarily confined to subluminal velocities. Recently, in fact, special relativity has been extended to superluminal inertial frames and to tachyons, thus allowing a self-consistent development of a "classical theory" of tachyons. It is shown that the "extended theory of relativity" allows in particular extending the Doppler-effect formulas to superluminal sources. The possibilities of radiocontact between subluminal and superluminal objects are considered as well. The behavior of tachyonic bodies in the gravitational field was clarified. Tachyons are predicted to suffer a gravitational repulsion (so they might be considered as the "antigravitational matter"); however, owing to their dynamics, they happen finally to bend towards the gravitational source, as usual objects do (even if with different curvatures). At last the problem of gravitational Cherenkov radiation (GCR) is studied. Contrarily to the previous authors, extended relativity predicts tachyons not to emit GCR in vacuum or in bradyonic (subluminal) media. (auth)

11754 CLASSICAL THEORY OF TACHYONS (SPECIAL RELATIVITY EXTENDED TO SUPERLUMINAL FRAMES AND OBJECTS). Recami, E. (Univ., Catania, Italy); Mignani, R. Riv. Nuovo Cim.; 4: No. 2, 209-290(1974).

The review is confined to the classical theory of superluminal objects, where classical means relativistic but not quantum mechanical. The main point is the generalization of special relativity theory to superluminal reference frames and tachyons. Also causal paradoxes are discussed, and the symmetries required by extended relativity are rendered more explicit. (JFP)

11755 GAUGE INVARIANT UNIFIED FIELD STRUCTURES, QUANTIZABLE DYNAMICAL SYSTEMS, CHARGE, AND SPIN STRUCTURES. Hurt, N. E. (Massachusetts Univ., Amherst). Rep. Math. Phys.; 4: No. 2, 131-138(Apr 1973).

Gauge invariant unified field structures on a manifold B are introduced. Necessary and sufficient conditions for their existence are studied. The connection with charge is studied; it is shown that such gauge invariant structures, e.g., quantizable dynamical systems, over simply connected manifolds B are completely classified by charge. Complex analytic gauge invariant unified field structures are studied. These structures over a complex analytic manifold B whose square is the canonical line bundle are in bijective correspondence with the spin structures on B. Finally, a class of homogeneous quantizable dynamical systems are shown not to carry spin structure. (auth)

11756 FIELD THEORY AT INFINITE MOMENTUM. Roskies, R. (Univ. of Pittsburgh). pp 174-195 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

An outline of the history and motivation for studying field theories at infinite momentum is given including the understanding of the $P \to \infty$ limit in order to put parton model calculations on a firmer basis, the development of a tool from the usual Feynman approach, and the understanding of the connection between ordinary field theory and light-cone-formulated field theory. It is hoped that this study will lead to a deeper understanding of field theories and a new set of approximations for both quantum electrodynamics and hadron physics. (JFP)

11757 CONFORMAL INVARIANT QUANTUM FIELD THEORY. Todorov, I. T. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 270-299 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

Lectures are given on the problem of whether it is possible to construct an exactly conformal invariant field theory model for all momenta. An attempt is made to construct off-shell Green functions. The manifestly conformal covariant technique is described; and the invariant two- and three-point functions are determined by a systematic use of conformal inversion invariance. The absence of ultraviolet divergences is proved in the skeleton graph expansion. Finally the possible relation with Lagrangian field theory is discussed. (JFP)

11758 CONFORMAL INVARIANCE AND SHORT DISTANCE BEHAVIOR IN QUANTUM FIELD THEORY. Mack, G. (Univ., Bern). pp 300-334 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

A survey is given of the bootstrap approach to the construction of a conformal invariant quantum field theory. Conformal invariance, construction principles, the absence of divergences, manifestly conformal invariant generalized Feynman rules, locality, spectrum condition and generalized unitarity, currents and stress tensor, relevance to the real world, solution of bootstrap equations in $6+\epsilon$ space-time dimensions, Feynman graph expansion of dynamical dimensions, the Ferrara-Grillo-Parisi-

Gato theorem and non-Bjorken scaling, and conformal invariant operator product expansions are covered. (JFP)

11759 KINEMATICAL ASPECTS OF CONFORMAL INVARIANCE. Grillo, A. F. (CNEN, Frascati, Italy). pp 335-342 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

A kinematical approach is used to discuss the consequences of conformal invariance on vacuum expectation values of local operators, and field theoretical models in two-dimensional space-time. (JFP)

11760 APPLICATION OF THE NORMAL-PRODUCT ALGORITHM (N.P.A.) TO ZERO MASS LIMITS, BROKEN SYMMETRIES, AND GAUGE FIELDS. Schroer, B. (Freie Univ., Berlin). pp 364-405 of Strong Interaction Physics. Ruehl, W. (ed.). New York; Springer-Verlag, New York, Inc. (1973).

From international summer Institute on Theoretical Physics meeting; Kaiserslautern, F.R. Germany (17 Jul 1972). See CONF-720738-.

It is shown that there is an appropriate method, the normal-product algorithm which allows one to give a simple discussion of zero-mass theories and the scale invariant Gell-Mann-Low limit. Gauge problems are considered in two theories: the abelian vector gluon theory and its quantum electrodynamics limit and the abelian broken symmetry theory of Higgs. (JFP)

11761 FIELD OBSERVABLES IN THE RADIATION GAUGE FOR THE MAXWELL AND SPIN TWO FIELDS. Oliveira, C. G. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Rev. Brasil. Fis.; 3: No. 1, 59-74(May 1973).

It is shown that, given the potentials for spin 1 massless fields the process of producing field potentials which commute with the generator of gauge transformation is equivalent to replace the classical commutator (the Poisson bracket), which holds for these initial potentials, by the Dirac bracket which describes the commutation algebra for the gauge invariant field potentials in the radiation gauge. This result is extended for spin 2 massless fields without self-interaction. This last case is taken as the weak field approximation of the full nonlinear gravitational field equations of general relativity. (auth)

11762 DERIVATION, EXTENSION, AND RENORMALIZATION OF EIKONAL-TYPE APPROXIMATIONS. Orzalesi, C. A. (Univ., Parma, Italy). Lett. Nuovo Cim.; 10: No. 3, 85-89(18 May 1974).

An exact eikonal equation is derived that leads to a new kind of renormalizable perturbation theory, which at high energy is much more appropriate than the conventional perturbation expansion. (LBS)

11763 FIELD THEORY AND INVARIANTIVE MECHANICS. Sofonea, L. (Univ. of Brasov, Romania); Ionescu-Pallas, N. Rev. Roum. Phys.; 19: No. 2, 121-135(1974).

Proceeding from the invariant two-body Lagrange function of analytical mechanics, an inductive method—the field equations compatible with the respective function are studied. Although from the Lagrange function emerge motion are studied exhibiting only approximately the Lorentz and Einstein invariance, during the induction process a full invariance is acquired. Under certain plausible assumptions, the general interaction lying inside a mechanical aggregate turns out to be an arbitrary mixture of scalar and vectorial fields. The possibility of inserting short range scalar interactions is also discussed. (auth)

11764 GAUGE INVARIANCE OF THE VACUUM POLARIZATION IN QUANTUM ELECTRODYNAMICS. Danos, M. (National Bureau of Standards, Washington, DC); Rafelski, J. Lett. Nuovo Cim.; 10: No. 3, 106-110(18 May 1974).

It is shown that the conventional perturbation formalism of field theory treats incorrectly the equal-time point in the chronological products of field operators. In particular, it is shown that the gauge invariance violating quadratic divergence of the vacuum polarization loop does not arise in the S-matrix formulation. (LBS)

11765 ARBITRARINESS OF COUPLING CONSTANTS IN ASYMPTOTICALLY FREE THEORIES. Sucher, J.; Woo, C. H. (Univ. of Maryland, College Park). Lett. Nuovo Cim.; 10: No. 3, 111-112(18 May 1974).

It was suggested by Salam and Strathdee (Lett. Nuovo Cim.: 9: 464(1974)) that coupling constants are not free parameters in asymptotically free theories. It is argued that the dispersion relation sum rule for the vertex function Γ in $g\phi^4$ theory is only an identity and does not constrain the coupling constant g. The point is demonstrated by considering the simple chain approximation to Γ in ϕ^4 theory. (LBS)

11766 SUM RULES IN ASYMPTOTICALLY FREE THEORIES. Salam, A.; Strathdee, J. (International Centre for Theoretical Physics, Trieste, Italy). Lett. Nuovo Cim.; 10: No. 3, 113-114 (18 May 1974).

A response is made to the suggestion of Sucher and Woo (Lett. Nuovo Cim.; 10: 111(1974) that the dispersion integrals for the coupling parameters in asymptotically free theories are likely to be identically satisfied and thus have the status of sum rules. (LBS)

11767 GENERALIZATION OF THE POWER-ZIENAU-WOOLLEY TRANSFORMATION IN QUANTUM ELECTRODYNAMICS AND ATOMIC FIELD EQUATIONS. Babiker, M.; Power, E. A.; Thirunamachandran, T. (Khartown Univ., Sweden). Proc. Roy. Soc. (London), Ser. A; 338: No. 1613, 235-249(4 Jun 1974).

A canonical transformation is performed on the conventional Hamiltonian for the electromagnetic radiation field and an assemblage of neutral molecules in interaction. The new Hamiltonian has interaction energies expressed in terms of the electromagnetic fields alone and these energies have direct physical significance. The terms linear in e are the multipole interactions, both electric and magnetic, and the term quadratic in e is a generalization of the elementary diamagnetic energy shift. The intermolecular Coulomb energies have cancelled with transverse polarization fields in the new Hamiltonian, although the intramolecular Coulomb potentials are left unaffected. The equations of motion that follow from the new Hamiltonian are deduced. They are the so-called atomic-field equations for the Maxwell fields and Schroedinger equation for an electron wave in a transverse electromagnetic field. The former are the microscopic analogs of Maxwell's equations in a medium (not restructed to dipole polarization fields) and the latter are dependent on the field strengths alone (not explicit functions of the vector potential). (auth)

11768 NATURAL LINE-BREADTH IN STOCHASTIC ELETRODYNAMICS. Surdin, M. (Bordeaux Univ., Talence). Int. J. Theor. Phys.; 9: No. 3, 185-193(Mar 1974).

The fact that the formalism of stochastic electrodynamics includes the reaction force, makes the calculation of the natural line-breadth straightforward. The evaluation of the relativistic correction to energy levels is greatly simplified in stochastic electrodynamics and brings out the concept of the propagation of the Coulomb field with the velocity of electromagnetic waves. (auth)

11769 NEW CLASS OF RENORMALIZABLE VECTOR-MESON THEORIES? Cornwall, J.M.; Levin, D.N.; Tiktopoulos, G. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. Lett. 32: No. 9, 498-501 (4 Mar 1974).

We propose a new class of apparently renormalizable heavy-vector-boson theories. These models are spontaneously broken gauge theories, modified by the addition of arbitrary mass terms for vectors associated with invariant Abelian subgroups. The vacuum is not invariant under these subgroups. Such theories are probably renormalizable since their multiparticle S-matrix elements are unitarily bounded in the tree approximation. As illustrations, the Higgs [U(1)] and Weinberg gauge theories are modified in this way. (auth)

11770 ELECTRON'S ANOMALOUS MOMENT AND ITS SPIN-PRECESSION FREQUENCY SHIFT. Lai, S.B.; Knight, P.L.; Eberly, J.H. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). Phys. Rev. Lett. 32: No. 9, 494-498 (4 Mar 1974).

We derive the anomalous moment of the electron from the quantum-electrodynamic equations of motion for the electron spin precession. (auth)

11771 ANALYSIS OF THE NEUTRAL-CURRENT INTERACTION IN THE INCLUSIVE NEUTRINO REACTIONS. Rajasekaran, G.; Sarma, K. V. L. (Tata Inst. of Fundamental Research, Bombay). Pramana; 2: No. 2, 62-72(Feb 1974).

A general phenomenological analysis of the neutral weak current in the inclusive neutrino reactions is attempted using the parton model as a tool. From the recently reported data on these processes the strength H of the neutral-current interaction as well as the amount of the VA interference are determined. The value $(H/G)^2 = 0.54 \pm 0.06$ where G is the Fermi coupling constant and the VA interference contribution turns out to be $33 \pm 23\%$ is found. Also the comparison of the data with various models for the neutral hadronic current is discussed. (auth)

11772 ULTRAVIOLET ASYMPTOTICS IN PRESENCE OF NON-ABELIAN GAUGE FIELDS. Belokurov, V. V.; Vladimirov, A. A.; Kazakov, D. I.; Slavnov, A. A.; Shirkov, D. V. (Moscow State Univ.). Teor. Mat. Fiz.; 19: No. 2, 149-162(May 1974). (In Russian).

A class of theories of the Yang-Mills fields interacting with scalar and spinor fields is considered, which includes models

with spontaneously broken symmetries. It is shown that all sufficiently simple models of such a type, except the massless Yang–Mills field interacting with fermions only, do not belong to the class of the weak coupling theories with respect to one of the coupling constants, at least. However, there exists the possibility, according to which in the ultraviolet limit the effective coupling constant of the four-meson interaction converges to finite value, while that of the Yang–Mills interaction converges to zero. This situation does not change qualitatively if the additional Yukawa interaction is taken into account. (auth)

11773 METHOD OF IMAGINARY TIME FOR PERIODICAL FIELDS. Popov, V. S. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 19: No. 5, 1140-1156(May 1974). (In Russian).

The method of imaginary times is formulated for periodical fields, $F(t + T) = F(t)$, where $F(t)$ is an external electric field satisfying the conditions necessary for the quasiclassical approach to be consistent. Ionization of atoms by a strong light wave and the pair creation from the vacuum are considered as the applications. Explicit expressions for the pair production probability w, applicable for any periodical field, are obtained in case of the linear polarization of the field $F(t)$. The probability w has different forms for fermions and for bosons due to that the field is periodical. Effect of the statistics of the created particles is mostly essential at $p_{\parallel} = 0$, i.e. for particles produced in a direction transversal to the electric field. In this case boson pairs are created only if an even number of quanta is absorbed, $n = 2K$, and fermion pairs are created only if an odd number is absorbed, $n = 2K + 1$. Properties of the exact solutions of the Klein–Gordon and Diračs equations with a periodical field and the relation to the quasiclassical approach are discussed. Pair creaction by an electric field with elliptic and circular polarizations is also considered by means of the method of imaginary times. (auth)

Gravitation and General Relativity

Refer also to abstracts 11111 and 11746.

11774 (IFA-FR-117-1974) EXPERIMENTAL METHOD FOR THE DETERMINATION OF THE GRAVITATIONAL INTERACTION VELOCITY IN NEWTONIAN GRAVITATIONAL FIELDS. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

An experiment is proposed for measuring the velocity of the gravitational interaction in Newtonian gravitational fields. The phase difference in time between the gravitation potential of the moon and the curve of a function of the position, in regard to a point on the earth, of the natural satellite is to be experimentally measured. The detection of the delayed moon potential is proposed to be made by means of a pendulum. (auth)

11775 (IFVE-STF-72-92) COVARIANT INTEGRATION OF TENSORS. Energy-Momentum in General Relativity Theory. Folomeshkin, V. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 28p. (In Russian). INIS.

A formulation is proposed for the operation of covariant integration of tensors in curvilinear-coordinates of euclidean space and in noneuclidean space. Consideration is given to the problem of formulating the principles of energy and momentum conservation in the general relativity theory. (SJR)

11776 (JINR-P2-7724) YUKAWA MODEL IN THE THREE-DIMENSIONAL SPACE–TIME. Zastavenko, L. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The method of irreducible coefficient functions is used. One can get rid of the divergences by adding the counterterm of the meson mass renormalization to the Hamiltonian and by extracting a specially selected infinite miltiplier from the Hamiltonian eigenfunction. (auth)

11777 COMMENT ON THE PAPER: AN EXPLANATION OF THE CLOCK PARADOX. Chamorro, A. (Univ., Bilboa, Spain). J. Phys., A (London); 7: No. 4, L41(1 Mar 1974).

An error in a recently published solution of the clock paradox is pointed out. (auth)

11778 COMPLEX RECURRENT SPACE-TIMES. Hall, G. S. (Univ. of Aberdeen, Scotland). J. Phys., A (London); 7: No. 4, L42-L44(1 Mar 1974).

Some similarities between P–P wave space-times and complex recurrent and conformally symmetric space-times in general relativity are discussed. (auth)

11779 VACUUM SPACETIMES WITH TWO-PARAMETER SPACELIKE ISOMETRY GROUPS AND COMPACT INVARIANT HYPERSURFACES: TOPOLOGIES AND BOUNDARY CONDITIONS. Gowdy, R.H. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Ann. Phys. (N.Y.) 83: No. 1, 203-242 (Mar 1974).

Spacetimes with closed spacelike hypersurfaces and spacelike two-parameter isometry groups are investigated to determine their possible global structures. It is shown that the two spacelike Killing vectors always commute with each other. Connected group-invariant spacelike hypersurfaces must be homeomorphic to $S^1 \otimes S^1 \otimes S^1$ (three-torus), $S^1 \otimes S^2$ (three-handle), S^3 (three-sphere), or to a manifold which is covered by one of these. The spacetime metric and Einstein equations are simplified in the absence of nongravitational sources and used to establish the impossibility of topology change as well as other limitations on global structure. Regularity conditions for spacetimes of this type are derived and shown to be compatible with Einstein's equations. (auth)

11780 A FLUID SPHERE IN GENERAL RELATIVITY. Adler, R.J. (The Institute for Advanced Study, Princeton, New Jersey 08540). J. Math. Phys. (N.Y.) 15: No. 6, 727-729 (June 1974).

We solve the Einstein field equations for the interior of a static fluid sphere in closed analytic form. The model sphere obtained has a physically reasonable equation of state, and a maximum mass of 2/5 the fluid radius (in geometric units). As the maximum mass is approached the central density and pressure become infinite, while for masses greater than about 0.35 times the fluid radius the velocity of sound in portions of the fluid exceeds the velocity of light, indicating that the fluid is noncausal in this mass range. In the low mass limit the solution becomes identical to the Schwarzschild interior solution. (auth)

11781 PARTONS AND GRAVITATION: SOME PUZZLING QUESTIONS. Santilli, R.M. (Department of Physics, Boston University, Boston, Massachusetts 02215). Ann. Phys. (N.Y.) 83: No. 1, 108-157 (Mar 1974).

The rather general belief in the theory of gravitation according to which neutral massive bodies with zero electric and magnetic moments are surrounded by a null electromagnetic field is analyzed from a critical viewpoint. Beginning the analysis at an atomic level, it is not difficult to see that neutral atoms are surrounded by a nonnull electromagnetic field generated by their peripheral electrons and by their nuclei even though their overall charge is zero. The data emerging from recent deep inelastic e-p scattering experiments clearly indicate that nucleons are composed by a number of charged constituents, often called partons, in a highly dynamical behavior. Consequently, nucleons and nuclei can also be a rather relevant source of electromagnetic field, in view of the presumed large number of partons, which is produced not only by their overall charges, but more properly by the charges of their individual constituents. Summing up the contributions from a large number of atoms, the possibility of a sizeable electromagnetic field surrounding any neutral massive body emerges. Three assumptions, termed standard, weak, and strong according to which the energy–momentum tensor of the electromagnetic field generated by the matter constituents does not contribute, or partially contribute, or is entirely responsible of the gravitational field, are introduced. In order to assess the physical relevance of each of the above assumptions, a simple bound state model of the π^0 particle is introduced in terms of two charged valence partons in a ^1S state. Some models of the electromagnetic field produced by the π^0 charged constituents are derived as a ground for further extension to the case of nucleons, nuclei, and entire atoms. The gravitational field equations for the π^0 particle according to the standard assumption are recalled and the ones according to the weak and strong assumptions are introduced. The puzzling implications of our analysis clearly cast shadows on the standard assumption, leaving as possible alternative for an exact formulation a selection between the weak and the strong assumptions. Some implications of the latter assumptions are discussed; the restrictions for the exterior case are derived using the framework of the "already unified theory"; some inconsistency with the gravitational wave theory is briefly discussed; and it is emphasized that the strong assumption implies a fully geometrical unification of gravitational and electromagnetic fields since the gravitational field is identified with a particular form, or "mutation," of the electromagnetic field originated primarily in the nuclear, but also in the atomic structure. The admissibility of both the weak and the strong assumptions on the basis of our present knowledge is discussed and the feasibility of some experiments aiming at the proper selection as well as the ultimate physical assessment of the new assumptions is briefly analyzed. (auth)

11782 A CASE OF METASTABILITY FOR SLOWLY ROTATING, SUPERMASSIVE OBJECTS. Dedic, H.; Tassoul, J. (Département de Physique, Université de Montréal). Astrophys. J. 188: No. 1, 173-179 (15 Feb 1974).

This paper deals with finite-amplitude axisymmetric pulsations of slowly rotating, supermassive objects. Fully nonlinear isentropic motions are described by means of Lagrangian variables. The scalar virial theorem in the first post-Newtonian approximation of general relativity provides an

approximate description of the oscillations of uniformly rotating bodies. It is well known that in a linear stability analysis, a cutoff of value γ_R of the adiabatic exponent γ unequivocally delineates unstable from stable motions. This work shows that when the effects of general relativity predominate (i.e., when $\gamma_R > 4/3$), γ_R merely separates unstable from metastable motions; and, whenever dynamical instability occurs, it always leads to a collapsing object. On the contrary, when the effects of rotation become paramount (i.e., when $\gamma_R < 4/3$), instability sets in when $\gamma \leq \gamma_R$; in the range $\gamma_R < \gamma < 4/3$, the body is then metastable; and the latter is always stable when $\gamma \geq 4/3$. Also, in this case, dynamical instabiliy is always associated with an expanding motion. A criterion for unconditional stability toward pseudo-radial pulsations is given in a practical form. (auth)

11783 ROSEN'S BIMETRIC THEORY OF GRAVITATION. Yilmaz, H. (Perception Tech. Corp., Winchester, MA). Lett. Nuovo Cim.; 10: No. 5, 201-204(1 Jun 1974).

It is shown that the field equations of Rosen's bimetric theory of gravitation are soluble and the solutions are the same as in Yilmaz's theory of gravitation. Some difficulties connected with Rosen's theory are discussed. (LBS)

11784 REMARKS ON THE LOCAL-SCALE-INVARIANT GRAVITATIONAL THEORY. Omote, M. (Univ., Tokyo). Lett. Nuovo Cim.; 10: No. 2, 33-37(11 May 1974).

A local-scale-invariant gravitational theory which was formulated in terms of Weyl's geometry was previously proposed. The theory is applied to cosmology with emphasis on the behavior of a scalar field ϕ in a cosmological background. It is shown that ϕ not only can vary with the cosmological time but also plays the role of the dimensions. (LBS)

11785 NEW CONSTANTS OF MOTION FOR SYSTEMS OF FREE GRAVITATING PARTICLES IN NEWTON'S AND EINSTEIN'S THEORIES OF GRAVITATION. Enosh, M.; Kovetz, A. (Tel Aviv Univ., Ramat Aviv, Israel). Ann. Phys. (N. Y.); 75: No. 2, 601-604(Feb 1973).

New quantities have been found which are constants of motion in Newton's gravitational theory. Analogous but different quantities exist in Einstein's theory. The difference between the Newtonian and the relativistic quantities may be used to distinguish experimentally between the theories. (auth)

11786 INERTIA AND GRAVITY: A NEW APPROACH TO DYNAMICAL THEORY IN GENERAL RELATIVITY. Quale, A. (Univ. of Oslo). Fortschr. Phys.; 21: No. 6, 265-325(1973).

A new approach to gravitational field dynamics is proposed, as an alternative to the standard formulation of general relativity. The space-time metric tensor is split, into an externally fixed background geometry (inertia) and a local dynamical field (gravity); and a dynamical theory of matter and gravity in the inertial background is developed. The physical origin of inertia (Mach's principle), and its observable properties, are discussed. The coordinate representations of inertia and gravity are found to have an internal gauge degree of freedom, due to the equivalence principle; the transformation properties of these fields, and the notion of covariant gauge conditions, are discussed. The dynamics of matter and gravitic fields is then investigated, using: The group of motion of the inertial background, appearing as an externally fixed Lie symmetry in the matter and gravity action principles, which yields weakly conserved energy-momentum-like objects; and an internal symmetry gauge group, yielding strongly conserved "internal currents." A fully covariant field-theoretical formalism is used, in which all quantities and operations are tensorial; the well known difficulties of "coordinate effects" in the standard nontensorial formulation are thus avoided. The physical significance of various types of conservation laws is discussed; and a complete family of energy-momentum tensors of gravity, covariantly conserved together with the matter energy-momentum, is deduced from a tensorial action principle. Treating gravity as an independent dynamical interaction, on an equal footing with other (matter) interactions, one is then finally led to the conclusion that the gravitic energy-momentum of a system is fully determined by the matter energy-momentum; various physical implications of this are discussed in some detail. (auth)

11787 SECOND-ORDER APPROXIMATION OF EINSTEIN'S GRAVITATIONAL THEORY IN FLAT SPACE-TIME. Cavalleri, G. (CISE, Milan); Spinelli, G. Nuovo Cim.; 21B: No. 1, 27-35 (11 May 1974).

Einstein's theory is translated into flat space-time as an expansion in the coupling constant f, truncated after f^2. This approximation is convenient to cover all the present experimental evidence, and turns out to be a particular case of the class of theories studied previously, starting from the field-theoretical approach in the unrenormalized flat space-time. The interaction and field Lagrangians are also found by the same procedure adopted previously. The energy-momentum density turns out to be a tensor, so avoiding the problem, present in the curved space, of the pseudotensors proposed for general relativity. (auth)

11788 SECOND-ORDER NONLINEAR LAGRANGIAN TENSOR FIELD THEORIES OF GRAVITATION IN AGREEMENT WITH RECENT OBSERVATIONS. Cavalleri, G. (CISE, Milan); Spinelli, G. Nuovo Cim.; 21B: No. 1, 1-26(11 May 1974).

Field equations and equations of motion for gravitation are obtained by an iterative method, starting from a Lagrangian density in the "unrenormalized" flat space-time. Assuming only a tensor potential, at first order in the coupling constant f one obtains the linearized Einstein theory. To get the higher-order consistency in the field equations, the matter tensor is replaced by the most general total energy-momentum tensor, which however is not unique, as it depends on arbitrary parameters (7 at second order in f). One then assumes that the field equations can be obtained from a Lagrangian density $L = L^f + L^{int}$, and a criterion is given to separate the field part L^f from the interaction part L^{int}. Finally by $L^{matter} + L^{int}$ the equations of motion are obtained. One thus obtains a manifold of theories depending on the 5 arbitrary parameters of $T^{tot}_{\alpha\beta}$ compatible with the Lagrangian formulation. By a convenient choice of the parameters Einstein's theory is recovered. The agreement with the latter at first order in f implies that the light deflection, the Shapiro delay experiment, the precession of gyroscopes and red shift are as in general relativity. The second-order effects can be different; e.g., the perihelion precessions depend on 3 of the 5 arbitrary parameters. A subgroup of the new class of theories can obviously fit the Dicke-Goldenberg observations. (auth)

11789 GENERAL RELATIVITY, UNITARIAN EINSTEIN THEORY, EXPANSION, AND AGE OF THE UNIVERSE. Pierucci, M. (Univ., Modena, Italy). Nuovo Cim.; 21B: No. 1, 69-96 (11 May 1974).

The inconsistency is shown of some reserves of which the unitarian Einstein theory, till now, was the object. Hence, by two quite different relativistic methods, almost perfectly coincident results are obtained for the age of the Unverse. At last we prove that the beginning of the expansion is not a repeatable event. (auth)

11790 GENERATION OF ELECTROVAC SOLUTIONS FROM VACUUM SOLUTIONS IN GENERAL RELATIVITY. Gopala Rao, A. V. (Mysore Univ., India). J. Phys., A (London); 7: No. 5, 597-599(21 Mar 1974).

The prescription given by Gautreau and Hoffman (Phys. Rev.; D2: 271-2(1970)) to generate axially symmetric electrovac solutions from the Weyl vacuum solutions in general relativity is shown to be completely equivalent to the procedure given earlier by Harrison (Phys. Rev.; 138: B488-94 (1965)) yielding, thus, only a known class of solutions of the Einstein-Maxwell equations. (auth)

11791 GENERALIZED KERR-SCHILD SOLUTION OF EINSTEIN'S EQUATIONS. Vaidya, P. C. (International Centre for Theoretical Physics, Trieste, Italy). Proc. Cambridge Phil. Soc.; 75: 383-390(1974).

A very general exact solution of Einstein's equation $R_{ik} = \sigma\xi_i\xi_k$ is given in terms of the Kerr-Schild metric, $g_{ik} = \eta_{ik} + H\xi_i\xi_k$ where ξ_i is a shearfree geodetic null congruence. The Kerr-Schild solution for $R_{ik} = 0$ is derived as a particular case. (auth)

11792 SPACE SYMMETRY. II. Khukhunashvili, Z. V. (Moscow Aviation Inst.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 6, 89-93(1973). (In Russian).

The purpose of the present study is the detection of all possible objects ψ which are transformed linearly $\hat{x}$ and intransitively with randomly transformed coordinates of x space. As a result of the studies it was shown that all three types of geometric objects transors, tensors, and M-objects exists. If the transors and tensors are described by a finite number of components, then the M-objects are described only by an infinite number of components. Some constants of dimensionality of length play an essential role in the transformed properties of M-objects. Objects in Minkowski space are studied. (tr-auth)

11793 GRAVITATIONAL FIELD OF A ZERO-MASS PARTICLE. Voronov, N. A.; Kobzarev, I. Yu. (Inst. of Theoretical and Experimental Physics, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 4, 1179-1186(Apr 1974). (In Russian).

A formula expressed in terms of delayed potentials is derived for the gravitational field of an extended wave packet produced at the definite moment of time. Limiting cases of the formula are compared with the results of other investigations and also with the result of direct integration of the delayed potentials for a point particle performed by methods of the generalized function theory. (auth)

11794 SCHWARZSCHILD PECULIAR SPHERE. Polishchuk, R. F. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 14: No. 6, 710-715(1973). (In Russian).

The geometry of the Schwarzschild solution was examined by means of preferential foliation. The curvature invariants for Kerr metrics, recording the ergosphere boundaries, were calculated. Some theorems were indicated. (tr-auth)

11795 COINCIDENCE ANALYSIS IN A GRAVITATIONAL-WAVE EXPERIMENT. Gusev, A. V.; Rudenko, V. N. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 14: No. 6, 706-709(1973). (In Russian).

The statistical problem on the detection of pulse signals during work with a coincidence circuit in experiments on the search for gravitational radiation from extraterrestrial sources was solved. (tr-auth)

REACTOR TECHNOLOGY AND REGULATION

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 11586, 11934, 11951, 11954, 11957, 11981, 12026, 12048, and 12052.

11796 (EUR-5055) EXPERIENCES WITH INSPECTION, MAINTENANCE, REPAIR WORK AND DECONTAMINATION IN NUCLEAR POWER PLANTS WITH LIGHT WATER REACTORS. (Lahmeyer International G.m.b.H., Frankfurt am Main (F. R. Germany)). 1974. 149p. (In German). Dep. NTIS (US Sales Only) $10.50. EUR BF 185,-.

After a preparatory study of the relevant literature and technical reports detailed discussions have been conducted with nuclear power plant operating staff in order to compile data on the experience acquired to date of repair, inspection, maintenance, and decontamination procedures and radiation-protection problems in nuclear power plants. The results are presented in the form of recommendations for the construction and operation of future nuclear power plants. The recommendations concern plant operators, constructors, subcontractors, and architect engineers and bodies responsible for the preparation of plant construction and for site supervision. Problems of a more general nature, which have emerged in the course of the study, are in some cases taken as the basis of recommendations addressed to national and supranational coordinating institutions. The majority of the recommendations are devoted to plant design, mechanical engineering, radiation protection and plant operation. A minor part concerns plant control, electrical engineering and civil engineering. Decontamination problems are discussed also. (auth)

11797 (EUR-5071) CORRELATIONS BETWEEN HEAVY ISOTOPES IN IRRADIATED FUELS OF LIGHT WATER POWER REACTORS. Foggi, C.; Frandoli, P. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Mar 1974. 60p. Dep. NTIS (US Sales Only) $6.00. EUR B.Fr. 85.-.

A theoretical study of the correlations between isotopes of plutonium and uranium in irradiated fuels of light water power reactors has been performed. The dependence of the correlations upon several reactor parameters (fuel enrichment, moderator-to-fuel volume ratio, cladding material, reactivity control method) has been analyzed; a wide range of possible lattices for pressurized reactors, and some specific lattices for boiling reactors have been considered. Analytical expressions for the correlations have been prepared in several cases. Comparison has been made with experimental data concerning the fuels of the reactors Trino Vercellese, Yankee Rowe, Dresden 1, Humboldt Bay. (auth)

11798 (NEDO-10602) TESTING OF IMPROVED JET PUMPS FOR THE BWR/6 NUCLEAR SYSTEM. Moen, R. H. (General Electric Co., San Jose, Calif. (USA). Atomic Power Equipment Dept.). Jun 1972. 14p.

The development and testing of improved BWR/6 product line jet pumps offered by the General Electric Company are described. Test results have shown that under steady-state and transient conditions increased efficiency is achieved by using five-jet nozzle jet pumps which results in increased total flow with a greater discharge head for the same amount of drive flow. Operational safety incentives for using these improved jet pumps are also taken in consideration. The same increased safety margins for the hypothetical major recirculation line break are achieved without exception with the improved jet pump design. The primary effect of the five-jet nozzle jet pump is that recirculation system efficiency is improved. (auth)

11799 (NEDO-10802) ANALYTICAL METHODS OF PLANT TRANSIENT EVALUATIONS FOR THE GENERAL ELECTRIC BOILING WATER REACTOR. Linford, R. B. (General Electric Co., San Jose, Calif. (USA). Atomic Power Equipment Dept.). Feb 1973. 139p.

The BWR has evolved into a single thermodynamic cycle power system. The General Electric Transient Analysis Methods for the single cycle BWR are described. Included are three major sections: 1) a derivation and documentation of the necessary equations for the reactor and the most common auxiliary control and operating system options, 2) a sensitivity study to identify the effect of system parameters on system transient performance and 3) a comparison of pre-startup system analysis using the most conservative system design specifications and the startup transient results obtained from operating plants. The major features of the transient methods are point reactor kinetics; lumped pressure nodes of the core, vessel and steamline; multiple recirculation loop options with reversed or startup flow capability utilizing both jet-pump and full flow recirculation systems; internal steam separators; a wide range of turbine control, pressure relief, rod motion, and protection system options; and recirculation flow control. (auth)

11800 (NEDO-20103) GENERAL DESIGN INFORMATION FOR GENERAL ELECTRIC BOILING WATER REACTOR RELOAD FUEL COMMENCING IN SPRING, 1974. (General Electric Co., San Jose, Calif. (USA). Atomic Power Equipment Dept.). Sep 1973. 50p.

The reload fuel described is an 8×8 fuel assembly configuration instead of the previously used 7×7. The pellet diameter, pellet length, cladding diameter, and rod pitch are changed from the 7×7 design; however, the assembly exterior dimensions remain unchanged. The basic materials and fuel fabrication process used for the 8×8 reload fuel assemblies are the same as those used on the 7×7 design. (auth)

11801 (SwRI-2154-p-11-23) REPLACEMENT OF SELECTED COMPONENTS IN THE LACBWR PRIMARY COOLANT PIPING SYSTEM. Herbert, P. J.; Burghard, H. C. (Southwest Research Inst., San Antonio, Tex. (USA)). 31 Aug 1973. Contract AT(11-1)-2154. 213p. Dep. NTIS $13.75.

Sensitized stainless steel components in the primary system of the LaCrosse Boiling Water Reactor were found to contain areas of intergranular stress corrosion cracking. Remaining components of sensitized stainless steel were located utilizing in-place metallography and were replaced with unsensitized stainless materials. A quality control plan was implemented to ensure that qualified materials were used and that the removal, installation, and inspection operations were performed by qualified personnel. (auth)

11802 BWR/6, LATEST IN GENERAL ELECTRIC SERIES. Atoomenergie Haar Toepass.; 16: No. 1, 20-23(Jan 1974). (In Dutch).

BWR/6 is the latest in G.E.'s series of boiling-water power reactors which began with BWR/1 (the Dresden-1 reactor) in 1955. After a brief recapitulation the main characteristics of BWRs/1-5 a more detailed account of the design, construction and operation of BWR/6 is presented. Some typical parameters for BWR/6 are: total power generated 3833MW(+) (~ 1100 MW(e)); channel power rating 0.44kW/cm; coolant inlet and outlet temperatures ~200° and 650°C respectively. (NL)

11803 BOILING WATER REACTOR CORE CONSTRUCTION. Fredin, B. (to Aktiebolaget Asea-Atom). US Patent 3,808,098. 30 Apr 1974. Priority date 27 Dec 1971, Sweden. 4p.

A boiling water reactor core is composed of a plurality of elongated parallel fuel assemblies of square cross-section. Each assembly is composed of a plurality of parallel vertical fuel rods occupying the majority of the positions of the intersecting points in a regular lattice. The remainder of the positions are occupied by a tube which is filled with water during operation. The gaps between two adjacent sides of each fuel assembly and the adjacent fuel assemblies are wider than those between the other two adjacent sides of the same fuel assembly and the adjacent fuel assemblies, and a cruciform control rod has two wings movable in the wider gaps. The central axis of the tube is located on the diagonal joining the intersecting points of the wider pair of gaps to that of the narrower pair of gaps, and is closed to the latter intersection. (Official Gazette)

11804 STATE OF THE ART IN BWR ROD BUNDLE BURNOUT PREDICTIONS. Guarino, D.; Marinelli, V.; Pastori, L. (CNEN, Rome). Nucl. Technol.; 23: No. 1, 38-52(Jul 1974).

Most published steady-state burnout experimental data on BWR square geometry rod bundles at 70 kg/cm^2 were analyzed and compared with the main calculation methods, in order to examine the state-of-the-art in burnout power predictions. The calculations were performed using two system parameter correlations – Barnett and Macbeth, a local condition correlation – Becker, and two hydrodynamic condition correlations – CISE-III and ACHAB. Furthermore, a selected number of representative cases were calculated by means of LEUCIPPO and COBRA-II subchannel codes, in which the Becker correlations for annuli and round tubes were applied to the peripheral and central subchannels, respectively. The comparisons showed that Becker and ACHAB methods predict the burnout powers with rms errors lower than 10%, while the subchannel analysis (applied neglecting the void drift) yields errors of 20 to 25%. 24 references. (auth)

11805 FUEL ELEMENT STORAGE TANK FOR NUCLEAR POWER PLANTS. Schettler, K.; Kuster, H. US Patent 3,807,599. 30 Apr 1974. Priority date 9 Jul 1970, F. R. Germany. 6p.

To avoid the escape of radioactive aerosols from the water surface of a fuel element storage tank, a continuous overflow of the water is maintained together with an air curtain disposed closely above the water surface. (Official Gazette)

11806 REACTOR VESSEL IN-SERVICE INSPECTION ASSEMBLY. Murray, T. R.; Burns, D. C. (to Westinghouse Electric Corp.). US Patent 3,809,607. 7 May 1974. Filed date 23 Nov 1971. 10p.

A nuclear reactor vessel in-service inspection assembly is provided for remotely, accurately positioning the inspection tool within the reactor vessel. The assembly has integral adjustment means whereby the tool is adapted to be used with a wide variety of vessel sizes. The inspection assembly is primarily adapted for ultrasonic, volumetric examination of the weld areas of the reactor vessel. (Official Gazette)

11807 EFFICIENCY OF THE DECONTAMINATION SYSTEM FOR RADIOACTIVE-GAS WASTE AT THE VK-50 ATOMIC POWER STATION. Yakshin, E. K.; Cherepov, A. G.; Chechetkin, Yu. V.; Keier, B. R.; Chukhlov, G. Z. Sov. J. At. Energy (Engl. Transl.); 34: No. 4, 354(Apr 1973).

Translated from At. Energ. (USSR); 34: No. 4, 285-286(Apr 1973).

Krypton and xenon radioactive gases are removed from the VK-50 Reactor by dynamic adsorption on activated carbon. The efficiency of the system for removal of these gases is discussed. (JWR)

11808 FABRICATION OF PRESSURE VESSELS. Ando, Y. (Tokyo Univ.). pp 21-40 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

Heavy section steel pressure vessels for light water reactor and aluminum tank for liquefied natural gas carrier are chosen to review the fabrication of pressure vessels. With regard to RPV, materials, effects of fabrication thermal history, fabrication procedure and advanced welding technique are dealt with. For the fabrication of aluminum cryogenic tanks for LNG carrier, a special factory equipped with plasma arc cutting, various automatic gas metal arc welding machines and so on, is advisable. (16 references) (auth)

11809 NUCLEAR FUEL ASSEMBLY SPACER. Ripley, C. C. US Patent 3,806,410. 23 Apr 1974. Filed date 31 Oct 1968. 10p.

An expanded sheet spacer for nuclear fuel rod assemblies is disclosed. The spacer consists of a single sheet which contains a pattern of slits which permit portions of the sheet adjacent the slits to be displaced successively in the same direction to form a plurality of parallel fuel rod receiving channels. (Official Gazette)

11810 TWO-PHASE FLOW INVESTIGATIONS IN A 7-ROD BUNDLE. Bosio, J.; Imset, O. R. (inst. for Atomenergi, Kjeller, Norway). pp 421-442 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Two-dimensional measurements of void fractions and velocities in the 7-rod bundle subchannels provide detailed information for the improvements of the physical models in cross flow and subcooled boiling. The transport model in COBRA II assuming thermal equilibrium in cross flow and mixing seems not to be valid as the experimental results show that void appears in the outer subchannels much earlier than predicted by the calculations. The subcooled boiling does not fit the experimental results. Physical models that will improve these errors have been incorporated in the subchannel computer code developed through this Scandinavian cooperation project. 5 references. (auth)

11811 EXPERIMENTS ON THE INFLUENCE OF RADIAL HEAT FLUX DISTRIBUTION ON CRITICAL HEAT FLUX IN BWR BUNDLE GEOMETRY. Gaspari, G. P. (CISE, Milan); Lucchini, F.; Marinelli, V.; Pastori, L. pp 443-463 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

An extensive experimental program with several 16 rod test sections having the typical geometry of Boiling Water Reactors is under way at CISE in the framework of the CNEN Plutonium Program fuel design development activities. Although several CHF data with simulated BWR square bundles are available in literature, the tests presented are particularly significant for the following reasons: full heated length of the test section: 366 cm, as in recent BWR reactors; the extent of the investigated ranges of mass velocity (12.200 g/cm^{2}s) and inlet quality (15.180°C of subcooling); and the detailed instrumentation for crisis detection enabling to detect the crisis position around the rod periphery. For the time being this program aims at investigating the effect of radial power distribution on Critical Heat Flux (CHF), in order to verify and to improve the accuracy of the available analytical models for predicting CHF both under steady state and transient conditions. In this connection, 6 different radial power distributions are programmed in a 16 rod cluster square geometry. The experimental results obtained with the first three test sections of the series (named respectively PELCO-B, PELCO-C, and PELCO-D) are presented. 16 references. (auth)

11812 MODEL FOR SUBCHANNEL ANALYSIS OF BWR ROD BUNDLES IN STEADY STATE AND TRANSIENTS. Forti, G. (EURATOM-CCR, Ispra, Italy); Gonzalez-Santalo, J. M. pp 464-503 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

A model is proposed for the thermohydraulic analysis of fuel rod bundles of BWR nuclear reactors. The single subchannel model is a two phase separated flow model with Zuber-Findlay formulation for vapor-liquid slippage and an empirical approach to two phase flow friction factor multiplier. The subcooled boiling region is treated by independent formulation for vapor generation at the heating surface and recondensation in the bulk of the coolant. The threshold for the inception of local boiling is related to the heating surface temperature as the main variable. The vapour generation is related to the heat transferred by boiling mechanism following Bowring's approach. The coupling among subchannels in the bundle is evaluated by imposing the same pressure differential in the axial direction for all the subchannels, and imposing the supplementary condition of no net flow in circulation loops among the subchannels. The whole scheme is embodied in to a finite difference computer programme MATTEO, by the means of which the experimental results of G.E. on a nine rod bundle have been checked. 8 references. (auth)

11813 EFFECT OF REDUCED CLEARANCE AND ROD BOW ON CRITICAL POWER IN SIMULATED NUCLEAR REACTOR ROD BUNDLES. Lahey, R. T. Jr.; Polomik, E. E.; Dix, G. E. (General Electric Co., San Jose, CA). pp 520-537 of Reactor heat transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

An extensive evaluation is presented of the effects of rod bow and reduced clearance for the critical corner rod of a BWR fuel bundle. For typical BWR operating conditions, experiments with realistic axial power profiles indicate maximum critical power penalties less than 4%. Since the geometry distortions of the test hardware are extreme cases which are not likely to occur in actual practice, this penalty value represents an upper limit for normal reactor design considerations. 6 references. (auth)

11814 RESULTS OF BLOWDOWN STUDIES WITH 4-ROD BUNDLES. Brand, B.; Hicken, E.; Loser, H.; Shueler, M. (Kraftwerk Union AG, Frankfurt am Main). pp 914-938 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In German)

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Within the framework of the emergency cooling program blowdown studies with 4-rod bundles in SER geometry were made. It was shown that the heat transfer coefficients after the critical heat flux is exceeded vary from 100 to 500 W/m^{2}K depending on the size and location of the fracture surface. The research also showed that by foaming the fluids in the lower plenum the directly heated hot rods, from temperatures up to 200°K over the saturation temperature of the fluid, can be rewet. 16 references. (trauth)

11815 TEST OF REACTOR AT THE TIME OF REGULAR INSPECTION. Experience in the Tsuruga Nuclear Power Station. Saito, M. (Japan Atomic Power Co., Tokyo). Genshiryoku Kogyo; 19: No. 12, 28-36; 58(Dec 1973). (In Japanese).

The Tsuruga nuclear power station, with a BWR plant, has been operated satisfactorily for over three years since its completion in March 1970. The fourth regular inspection was performed in 1973 according to the Electric Enterprise Law, and is described. It took about 45 days from reactor shut-down to re-start up. The testing and inspection of its primary system were as follows: integrity of reactor-coolant pressure boundaries; inspection of fuel; safety valves, and main-steam isolation valves; testing safety engineering systems; control and instrumentation; reactor containment vessel; leakage of reactor building; emergency stand-by generator; and radiation-exposure control. (JA)

11816 FAILED FUEL DETECTION SYSTEM FOR AN ADVANCED THERMAL REACTOR. Nakano, M.; Kaneko, Y. (Fuji Electric Co. Ltd., Tokyo). FAPIG (Tokyo); No. 69, 8-12 (May 1973). (In Japanese).

The failed fuel detection system for an advanced thermal reactor was developed and tested on the basis of the precipitator method utilized in gas cooled reactors. The precipitator detects fuel failure by detecting two nuclides making double beta decay, Xe and Kr, among the fission products emitted by the fuel failure. This method has higher S/N ratio and higher detection efficiency than other failed fuel detection methods and can be used only in a gaseous phase. It is a problem to gather rare gases from sampled water, when this method is applied to water cooled reactors. In order to resolve this problem, a flush tank was designed making it possible to separate rare gases from sampled water by making use of the phase transition of water as well as of the decrease of solubility at the time of discharging high temperature and high pressure water into a low pressure vessel. A development test was performed in the following three steps; system test which confirms the stable operation of two phase flow system and carrier gas system, performance test which examines the efficiency of separating rare gases in the flush tank, and endurance test which examines corrosion effect in machinery and pipings. (JA)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 11797, 11805, 11806, 11808, 11809, 11816, 11931, 11932, 11934, 11935, 11939, 11965–11974, 11977, 11981, 11987–11989, 12026–12028, 12049, and 12053.

11817 (AEC-tr-7528) CHEMICAL CONDITIONING OF THE PRIMARY AND SECONDARY SYSTEMS OF PRESSURIZED WATER REACTORS. Riess, R. (USAEC Technical Information Center, Oak Ridge, Tenn.). 1972. Translation of pp 14-21 from the VGB Feedwater Conference, Essen, Germany, 1972. 29p. Dep. NTIS $3.50.

The chemical conditioning of water in the primary and secondary cooling systems of a PWR type reactor is analyzed. 24 references. (DCC)

11818 (IRS-S-1) UNTERWESER NUCLEAR POWER PLANT: ANSWERS TO FREQUENTLY RAISED QUESTIONS. Franzen, L. F. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F.R. Germany)). Nov 1971. 11p. (In German). INIS.

Comment on the objections raised by the "International Union for the Protection of Life" with regard to the following aspects concerning the project of the nuclear power plant Unterweser: soil investigations, seismic hazards, ground concussion, catastrophe planning, warlike effects, unit size, steam turbine, pressure vessel, concrete shielding, safety against high water, and insurance problems. (GE)

11819 (ORNL-TM-4443(Rev. 1), pp vp, Paper 19) CEMSO: A CORE SIMULATION PROGRAM FOR PRESSURIZED WATER REACTORS. Rieck, T. A. (Commonwealth Edison Co., Chicago). May 1974.

From nuclear utilities planning methods symposium; Chattanooga, Tennessee, USA (16 Jan 1974).

In collection of papers presented at the nuclear utilities planning methods symposium.

The CEMSO code is a scoping tool for determining core reloads for the pressurized water reactors operating, under construction, or planned for the Commonwealth Edison System. With additional modification CEMSO could become an in-core simulator for use in the System Simulation Program. Input to CEMSO consists of specifying the reactor to be analyzed, the reactor startup date, the thermal power the reactor core is required to produce in each of N cycles considered, and the time each cycle begins and ends. The CEMSO output contains reload fuel specifications, fuel shuffling patterns, power distribution maps, discharge fuel energy generation and isotopics, and a complete economic analysis. (5 references) (auth)

11820 (ORNL-TM-4570) ANALYSIS OF NEUTRON-DENSITY OSCILLATIONS RESULTING FROM CORE BARREL MOTION IN THE PALISADES NUCLEAR POWER PLANT. Fry, D. N.; Kryter, R. C.; Robinson, J. C. (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W-7405-eng-26. 29p. Dep. NTIS $4.50.

Neutron noise signatures were obtained on August 3, 1973, that were due to abnormal movement of the core barrel at the Palisades Nuclear Plant. Frequency spectra, rms noise, and amplitude probability density were recorded as sensed by ex-core and in-core neutron detectors. These signatures will serve as reference data for future studies of core-barrel motion at the Palisades plant. Also, the results are presented in units that should make them useful for noise diagnosis in other pressurized water reactors. (auth)

11821 (WCAP-8185(Amend. 4)) REFERENCE CORE REPORT, 17 × 17. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). PWR Systems Div.). 16 May 1974. 40p.

11822 (WCAP-8185(Amend.5)) REFERENCE CORE REPORT 17 × 17, AMENDMENT 5. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). 5 Jun 1974. 25p.

11823 (WCAP-8252) DOCUMENTATION OF SELECTED WESTINGHOUSE STRUCTURAL ANALYSIS COMPUTER CODES. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Apr 1974. 268p.

Information concerning the qualification and verification of structural analysis computer codes used in PWR plant design analyses is presented. This documentation provides a licensing basis for the safety requirements in future plans in which the codes are used in design analyses. (JWR)

11824 (WCAP-8317) PREDICTION OF THE FLOW-INDUCED VIBRATION OF REACTOR INTERNALS BY SCALE MODEL TESTS. Lee, H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Mar 1974. 67p.

It is shown that $\frac{1}{24}$th scale model test results accurately predict the flow-induced vibration and modes of full-size reactor internals. Dimensional analysis principles are reviewed and the similitude requirements for valid model tests of the flow-induced vibration of reactor internals are identified. Test results on reactor internals flow vibration models are presented and compared with plant test results. Reactor internals with neutron pads are shown to vibrate only about one-third as much as internals having a thermal shield. The dominant flow vibration mechanisms of reactor internals are shown to include flow turbulence. Random vibration theory as it applies to the flow-induced vibration of reactor internals is discussed and a simplified method is derived for calculating modal rms vibration displacement from measured linear acceleration spectra. A scaling law for the turbulence-excited vibration of reactor internals is developed. The scaled displacement power spectral densities of the model internals are very similar to those of $\frac{1}{7}$th scale internals and in a typical case that is calculated the scaled cantilever beam mode vibration amplitude predicted from the model test results give a close correlation with the corresponding value measured in a plant test. (auth)

11825 OFFSHORE NUCLEAR POWER PLANTS: AMERICAN REALITY. Maniago, D. P (Offshore Power Systems, Jacksonville, FL). Atomwirt., Atomtech.; 19: No. 3, 125-129(Mar 1974). (In German).

The recent developments concerning environmental problems, costs and building time of nuclear power plants, brought about in the USA the realization of an idea, which is not new in itself: to erect nuclear power plants near the shore in the sea. The first projects will be realized by Offshore Power Systems, daughter firm of Westinghouse and Tenneco, in form of plants inside breakwaters. The basic particularities and advantages of offshore nuclear power plants as well as the specific ones of the first two projects Atlantic-1 and -2 are described. The most important advantages of the new concept are the opening up of totally new sites and the mass production of identical power plants in one factory. They are dragged as a complete station on a floating platform to the respective site. (GE)

11826 POSITION DEPENDENT SIMULATION OF THE CORE DYNAMICS OF A PRESSURIZED WATER REACTOR. Born, H. Stuttgart; Univ. Stuttgart (1972). 58p. (In German). (IKE-5-160d).

Thesis.

Computer programs are required for the simulation of nuclear reactors. Two computer programs are described which simulate the dynamic behavior of a reactor after disturbance. The program takes into account the temperature reaction on the cross sections, the other calculation deals with temperature dependent reactivity. At the start of the disturbance, the reactor is in stationary operation, hence a third program is made for calculating the state variables of the reactor which is to be taken as the initial variable for the two other programs. All programs calculate in one dimensional geometry and the diffusion theory serves as physical basis. (GE)

11827 EXPERIMENTAL INVESTIGATION OF MASS VELOCITY AND ENTHALPY EXCHANGE AMONG THE SUBCHANNELS

OF LWR ROD BUNDLES IN SINGLE-PHASE FLOW. Guerrieri, V. (CNEN, Casaccia, Rome); Kjellen, B.; Marinelli, V. pp 211-229 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Subchannel computer codes, which constitute the basis for the thermohydraulic design of PWR fuel elements need the knowledge of the turbulent mixing enthalpy exchange intensity among the coupled subchannels. To the purpose of having experimental information by which to optimize the mixing correlations used in the codes, velocity and temperature measurements have been taken at the outlet of 2 16-rod test sections. The former reproducing a clean geometry, and the latter fitted by a spacer grid, 4 different heating configurations being used. These local measurements allow the calculation of the average subchannel values of temperature and velocity, varying the mixing parameter in the subchannel code until the best agreement is found between the calculated and measured temperatures, it is possible to obtain the optimum mixing coefficients. 3 references. (auth)

11828 EXPERIMENTAL RESULTS OF CORE FLOODING STUDIES WITH A 340-ROD BUNDLE. Riedle, K.; Winkler, F.; Amm, H. (KWU, Erlangen, Ger.). pp 893-913 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In German)

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The experimental installation for the simulation of the DWR reactor in the core-flooded condition and the instrumentation used to monitor its behavior were described. The data obtained was processed by the STRETCH and STABA programs to determine the transient behavior of the rod temperatures, the heat transfer coefficients, and the water level in the rod. A model based on the experimental results was derived for a description of the core behavior during flooding. 3 references. (JSR)

11829 TEST OPERATION OF PWR POWER PLANT. Nakanishi, K. (Mitsubishi Atomic Power Industries, Inc., Tokyo). Genshiryoku Kogyo; 19: No. 12, 14-18; 27(Dec 1973). (In Japanese).

After outlining the test operation of a PWR power plant including various aspects before the test, the following items are described: cold state and warm state functional tests of various reactor plant systems, fuel loading, pre-critical test, first criticality, reactor-physics test, transient response test, and performance test. The warm state functional test follows on the cold state functional test. In the PWR plant, total core charge is made all at once, so that work is relatively simple. Then, the pre-critical test is made in both cold and warm state after the installation and adjustment of equipment. In the reactor physics test, the nuclear characteristics of a reactor core are examined to confirm design values and parameters for accident analysis, and the transient response test provides the dynamic characteristics of the overall reactor plant. (JA)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 9272, 11816, 11943–11945, 11956, 12024, and 12026.

11830 (DUN-7971-B) PT-N-6, ISOTOPE PRODUCING RODS IN N REACTOR. Final Report. Larkin, D. L. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 9 Jul 1973. Contract AT(45-1)-1857. 11p. Dep. NTIS $4.00.

The history of Production Test N-6 is given, and the results of the irradiation of isotope rods 23 and 27 are given. Both isotope rods have been replaced by normal boron carbide control rods, thus terminating further testing. The results of the rod calibrations done at the time of their recharging with target material during the summer outage of 1972 are included for completeness. Analysis of the experimental data indicates that the newly charged rods had a poison worth within that predicted from previous operating experience. (auth)

11831 (GA-9261) PUBLIC SERVICE COMPANY OF COLORADO 330-MW(e) HIGH-TEMPERATURE GAS-COOLED REACTOR RESEARCH AND DEVELOPMENT PROGRAM. Quarterly Progress Report for the Period Ending March 31, 1969. (Gulf General Atomic Co., San Diego, Calif. (USA)). 29 Apr 1969. Contract AT(04-3)-633. 150p. Dep. NTIS $10.50.

Research and development on several tasks during the period are summarized. The tasks included component development, nuclear analysis, fuel development, full element proof testing, fuel transfer machine development, testing of the series steam-turbine-driven helium circulator, control rod drive testing, steam generator development, and coated particle development. (JWR)

11832 (GA-A-12910) THERMAL CONDUCTIVITY OF LARGE HTGR FUEL RODS. Johnson, W. R. (General Atomic Co., San Diego, Calif. (USA)). 15 Mar 1974. Contract AT(04-3)-167. 46p. Dep. NTIS $4.00.

The thermal conductivities of six types of unirradiated prototype large HTGR fuel rods, representing the maximum and minimum fissile and fertile fuel loadings for a large HTGR core, have been measured in vacuum and in helium by a radial heat flow direct heating method at 950° to 1250°C. The thermal conductivity of the fuel rods was found to decrease slightly with increasing temperature and to increase with increasing graphite shim particle content. The thermal conductivity of several representative fuel rods was found to be insensitive to a change in the test environment from vacuum to 1 atm of helium. An analysis of the irradiation-induced conductivity changes observed for the various components of a fuel rod indicates the thermal conductivity may be expected to decrease with irradiation in the low-temperature range of operation of the fuel (600° to 1000°C) and to increase or remain constant in the upper fuel temperature range (1000° to 1400°C). (12 references) (auth)

11833 (GA-A-12920) PREIRRADIATION REPORT: HRB-4 AND HRB-5 IRRADIATION CAPSULES. Johnson, W. R. (General Atomic Co., San Diego, Calif. (USA)). 15 Mar 1974. Contract AT(04-3)-167. 56p. Dep. NTIS $5.45.

Capsules HRB-4 and HRB-5 are the latest in a series of monitored-capsule experiments involving irradiation in the beryllium-reflector region of the Oak Ridge National Laboratory (ORNL) HFIR. These capsules are sponsored by ORNL but represent a cooperative ORNL/GGA irradiation effort. The HRB-4 and HRB-5 capsules both began their irradiations on October 8, 1972. Capsule HRB-4 is scheduled to be removed from its position in the HFIR in late June 1973, at which time it will have experienced a maximum fast fluence of approximately 8×10^{21} n/cm^2 (E < 0.18 MeV, 11 cycles). Capsule HRB-5 was scheduled for irradiation to a peak fluence of approximately 4×10^{21} n/cm^2 (5 cycles) and was removed from its position in the HFIR on February 3, 1973. The design temperature for both capsules is 1200°C, and both capsules are being monitored for in-pile fission-gas release during irradiation. In addition to ORNL's experimental material each capsule contains two each of three different types of GGA fuel rods (12 rods total in the two capsules) and represents the first GGA irradiation effort designed to evaluate the irradiation performance of fuel rods fabricated using a new candidate process (admix-compaction, cure-in-place) and candidate materials (three non-FSV matrix materials and two types of graphite shim particles) for large HTGR startup and recycle fuel systems. (auth)

11834 (JUL-1017-RG) TECHNOLOGICAL AND COMMERCIAL POSSIBILITIES WHICH RESULT BY USING A HIGH-TEMPERATURE REACTOR FOR THE FUTURE SUPPLY OF MINERAL OIL IN THE FRG. Eickhoff, H. G. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Reaktorentwicklung). Nov 1973. 88p. (In German). Dep. NTIS (US Sales Only) $7.50.

Thesis. Submitted to Technische Hochschule, Aachen (West Germany).

An analysis of the total fossil energy resources in the world and a comparison with future requirements shows very clearly that nuclear reactors have to be applied to save the available reserves of oil. Technological efforts and commercial possibilities of high-temperature nuclear process heat in the FRG are shown till the year 2000. The increasing environmental burden (especially the SO_2-emission) caused by burning fossil fuel has been considered in particular. This is followed by an examination of the processes which enable the production of synthetic liquid hydrocarbons if the reserves of oil are exhausted. To make a statement about the costs which arise by coupling nuclear process heat to endothermal processes, quantity balances and energy balances have been set up. The possible process configurations of the coupling assembly "HTR-conversion process" are shown in the flow sheets. It was possible to show that the introduction of the new technologies in oil processing requires the availability of cheap hydrogen. (GE)

11835 (KFA-IRE-14-71) DEVELOPMENT WORK ON HIGH-TEMPERATURE REACTORS IN THE FEDERAL REPUBLIC OF GERMANY. Schulten, R. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Reaktorentwicklung). Mar 1971. 5p. (In German). INIS.

The first experiments on high temperature reactors were

gained from the three-year operation of the AVR-reactor. Experience on the circulation of radioactivity, the contamination and helium leakage was most positive. During operation the functioning of the components was demonstrated. Duration tests for fuel elements at high temperatures and at high burn-up were carried out. Safety experiments showed the particularly high quality of safety in this type of reactor. The thorium high temperature reactor (THTR) being built at present is a logical further development based on this operational experience. The prestressed concrete containers and the inserted core rods are used as new components. The experience up to present, permits considering helium starting temperatures of up to 1,000°C which seems to be suitable for future development programs for gas turbines and for the inclusion of process heat. (GE)

11836 (KFA-IRE-22-71) TEMPERATURE DISTRIBUTION IN THE RADIAL REFLECTOR AND CARBON BRICK OF THE PR 500 IN THE STATIONARY STATE. Bonka, H.; Sammeck, K. H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Oct 1971. 18p. (In German). INIS.

In order to improve the thermal insulation and to further reduce radiation, the design of the process heat reactor PR 500 provides for a 86 cm thick carton brick layer between the reactor and the prestressed concrete vessel. According to this design, the reflector is cooled by means of the cold cooling gas which is recycled through a number of borings in the reflector. The temperature distribution in the reflector and the carbon brick layer are calculated for this new cooling concept as well as for two other cooling concepts. The results show a clear advantage of the cooling channel concept over the two others with respect to maximum temperature in the reflector. (GE)

11837 (NP-20025) REACTORS: UK FIFTH EDITION. (UKAEA London Office). Aug 1972. 181p. Dep. NTIS (US Sales Only) $12.25.

The various United Kingdom nuclear reactor plants in operation as of 1972 and those planned through 1975 are listed. Details of the general uses and history of each reactor are given together with illustrations and tables of main reactor data. (DG)

11838 (NUKEM-119) CLOSING THE HTR FUEL CYCLE. Tillessen, U.; Jauer, H.; Kayser, J. (Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Wolfgang/Hansu (F.R. Germany)). Aug 1973. 43p. (In German). INIS.

On the basis of the market forecasts for High-Temperature Reactors (HTR) in Europe, optimum data for the commissioning and capacity of the first large plant for reprocessing and refabrication are developed, based on proven technology whenever possible, and on available research. According to these calculations, the optimum design of such a plant should provide for a capacity to reprocess the spent fuel of a 50.000 MW(e) HTR plant, assuming the reprocessing plant to be operated, for technical reasons, up to 50% of its full capacity in its first year, and to 75% and full capacity in its second and third year. Full capacity operation will represent the reprocessing of 350 tons of heavy metal a year, and an annual output of 15 tons of refabricated ^{233}U. An interim solution has to be found for the period up to the commissioning of the first large reprocessing plant and several alternate possibilities were investigated. The storage of the fuel elements seems to be the best solution with regard to costs, with the disadvantage, however, that it will not permit any know-how to be obtained in the FRG and in Europe with regard to the construction and operation of a reprocessing plant. This can be obtained by building a prototype plant for the combustion of the graphite (Headend) as well as by re-building an available plant, e.g., the WAK, Karlsruhe. In order to be able to obtain the required know-how in Europe by the operation of prototype plants, design and development work should be initiated sbortly. Another alternative examined is the transport of spent fuel elements to the USA. This would offer the advantage that the fuel cycle in Europe and the FRG could be closed at an earlier date. This would involve higher expenses and would not allow these countries to obtain the technical know-how required to keep abreast with the development in other parts of the world. The closing of the fuel cycle is one of the major conditions governing the introduction of the HTR on the European market. Technical data on which further decisions will be based is presented. (GE)

11839 (ORNL-tr-2790) COMPUTATIONAL METHODS FOR GRAPHITE GAS COOLED REACTORS SHIELDING: COMPARISON WITH SHIELDING MEASUREMENTS MADE DURING START-UP TESTS. Brisbois, J.; Duco, J.; Bourdeau, F.; Chapus, J. (CEA, 75-Paris (France); Electricite de France, 75-Paris). [nd]. Translation by M. Gerrard of CEA-CONF-2213. 31p. Dep. NTIS $4.75.

The main shielding problem of the graphite gas-cooled reactors, in particular for reactors with integrated exchangers, is the possibility of access inside the primary system after shut down, for inspection or repairs of the internal structure. The problem arises essentially above the exchanger which is protected from direct radiation by a shield located in the structure of the supporting area and at the lower end of the peripheral gap provided for "cold" gas flow and which is a privileged path for neutrons from the reactor core. The computational methods which were developed and their adjustment on mock-ups are described. Results obtained on the Saint Laurent I, Saint Laurent II and Bugey power plants by shielding measurements during start-up are compared to predictions made from the calculation methods. (auth)

11840 POWER PROFILE MANIPULATION IN BLOCK-FUEL HTGRs. Maly, V.; Teuchert, E. (Kernforschungsanlage, Juelich, Ger.). Nucl. Technol.; 22: No. 3, 331-334(Jun 1974).

A favorable distribution of fuel temperature in block-fuel HTGRs can be achieved by an axial shift in the power density toward the cooling gas inlet. This is of particular importance for advanced reactor applications requiring gas outlet temperatures above 900°C. The concept of axially graded heavy-metal densities and fuel enrichment allows for achieving and maintaining the desired asymmetrical power profile through the entire period of fuel insertion. (auth)

11841 GRAPHITE-IRRADIATION IN HIGH-TEMPERATURE REACTORS. III. Blackstone, R. (Stichting Reactor Centrum Nederland, The Hague). Atoomenergie Haar Toepass.; 16: No. 2, 37-48(Feb 1974). (In Dutch).

Operating and shutdown stresses in the graphite moderator of some typical HTRs for various irradiation levels and operating temperatures are calculated. It is concluded that undue stresses will not be incurred during the reactor lifetime for temperatures up to 900°C, and probably up to 1200°C, although confirmatory experiments are desirable at this latter temperature. For extrapolation of the theory up to even higher temperatures (~1400°C), more data would certainly be required. (NL)

11842 FUEL ELEMENT FOR A NUCLEAR REACTOR. Ballagny, A. (to Commissariat a l'Energie Atomique). US Patent 3,808,099. 30 Apr 1974. Priority date 25 Jun 1971, France. 4p.

The fuel element comprises a graphite casing of generally cylindrical shape and constituted by two coaxial tubular sleeves closed by an end-cap at each extremity and forming an annular space in which cylindrical compacts of fissile material are arranged in a stack, the inner sleeve of the casing being provided with one or a number of longitudinal slits formed radially or at an oblique angle through the entire thickness of the sleeve. (Official Gazette)

11843 FRICTION FACTOR OF ROUGHENED FUEL PINS IN BOTH LAMINAR AND TURBULENT FLOW REGIONS. Collinson, B. (United Kingdom Atomic Energy Authority, Windscale, Eng.). pp 54-62 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The results are presented of pressure drop measurements on annuli formed by either smooth or roughened pins inside a smooth channel. The Reynolds number range covered extended from 500 to 10^6, i.e., both laminar and turbulent flow regions. 6 references. (auth)

11844 EFFECT OF GRAPHITE SURFACE ROUGHNESS ON FUEL ELEMENT PRESSURE DROP. Collinson, B. (United Kingdom Atomic Energy Authority, Windscale, Eng.). pp 87-110 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The results are presented of friction factor measurements on three types of artificially roughened graphite sleeves having center-line-average (CLA) roughness values of 4.02, 9.44 and 15.85 microns CLA respectively. In the case of the 4.02 micron CLA sleeve care was taken to minimize machining marks, hence this value of surface roughness could be assumed to be mainly caused by the porosity of the graphite. Steel sleeves having roughness values of 0.127, 1.78 and 5.09 microns CLA were also tested to provide a smooth surface datum and also to give data for sleeves whose roughness was caused solely by machining marks. These results are then used to assess the effect of graphite surface roughness on fuel element pressure drop for a range of fuel element designs. 5 references. (auth)

11845 HEAT TRANSFER AND PRESSURE DROP DATA FOR HELIUM FLOW IN SMOOTH ANNULI. Furber, B. N.; Appleby, G. G.; Facer, R. I.; Wright, D. (Nuclear Power Group Ltd.,

Risley, Eng.). pp 281-300 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Experimental work carried out with helium flowing in smooth annuli of diameter ratios 1.47 and 1.20 is described. The inner surfaces of the annuli were heated and local heat transfer measurements were taken at length to equivalent diameter ratios from 2 to 85. Particular emphasis has been placed on determining the influence of heat flux at two nominal Reynolds numbers of 10^4 and 2×10^4 on both local Stanton number and overall friction factor. The test conditions were influenced by HTR designs at present under consideration. 5 references. (auth)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstract 11837.

11846 (CNEA-CNA-1) ATUCHA REACTOR. Physical Principles, Design, and Operation. Huber, H. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1973. 98p. (In Spanish). INIS.

The booklet gives to the personnel of the Atucha power plant the basic data on the operation of the reactor, its functioning, and the data on which its design is based. The general concepts of reactor physics are outlined. The Atucha reactor and its thermal and physics design are described. Details on its operation, presented in general and specific form, should be read in conjunction with operation manuals. (tr-auth)

11847 CRITICAL HEAT FLUX UNDER TRANSIENT CONDITION (CASE OF TRANSIENT HEAT INPUT). Aoki, S.; Inoue, A.; Kozawa, Y., Furabayashi, T.; Aritomi, M.; Nakajima, T.; Okazaki, H. (Tokyo Inst. of Tech.). pp 577-597 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Both the thermal behavior of boiling two-phase flow at transient heat input and its effect on burnout phenomena are analyzed. The test section of Able loop consisted of an annular flow channel between the outside wall of 25 mm ID and the heater rod of 10 mm OD, whose effective length were 500 and 800 mm. The modes of heat input were rampwise and stepwise. The tests were conducted at pressure of 21 and 71 at. From the experimental results it seems that there exist three regions, wherein the effect of ramp rate at rampwise transient on CHF differs each other widely depending on the inlet subcooling, inlet flow rate or on the exit quality at burnout inception. The case of stepwise input can be dealt as the special case of the rampwise input having large ramp rate. The burnout time becomes shorter as the stepwise heat input increases and also as the exit quality at burnout decreases. 11 references. (auth)

Power Reactors, Breeding

Refer also to abstracts 9370, 10435, 11809, 11837, 11933, 11936, 11941, 11942, 11947–11950, 11952, 11960–11964, 11981, 11992, and 12026.

11848 (ANL-8006) EFFECT OF RANDOM TEMPERATURE FLUCTUATIONS ON CREEP AND CREEP RUPTURE OF CYLINDRICAL TUBES. Huang, W. N.; Valentin, R. A. (Argonne National Lab., Ill. (USA)). Feb 1974. Contract W-31-109-eng-38. 31p. Dep. NTIS $4.00.

The qualitative and quantitative implications of random temperature data are considered by deriving expressions for the expectation value and variance of quantities such as displacement and stress in creep of thin, pressurized tubes. Also, a nondeterministic analog of an existing theory of creep rupture is used to study the impact of random temperature fluctuations on time to brittle and ductile rupture. Data for stainless steel, together with analytical considerations, are used to formulate qualitative generalizations of importance to the design process. (auth)

11849 (ANL-8074) INSPECTION FEASIBILITY OF GROOVED DUPLEX TUBES. Reimann, K. J.; Busse, T. H.; Massow, R. B.; Sather, A. (Argonne National Lab., Ill. (USA)). Mar 1974. Contract W-31-109-eng-38. 42p. AT.

The results of an attempt to characterize and inspect duplex tubes for sodium-heated steam generators are presented. Ultrasonic inspection of the inside and outside tubes was accomplished, with a high confidence level, using standard techniques and equipment. Calibration notches on the inside and outside surfaces were easily detected. The grooved outside tubes could be inspected at the same sensitivity level when the tubes were translated lengthwise or rotated slowly. Suggestions for suppression of groove reflections to implement helical scanning are given. The duplex tubes were examined in a manner similar to that used for the grooved outside tubes. The U-bends of duplex tubes were inspected radiographically and by the pulsed eddy-current and dye-penetrant techniques. No deleterious effects of the bending operation were detected. (auth)

11850 (ANL-8094) ANALYSIS OF THE KELVIN–HELMHOLTZ INSTABILITY AT THE GAS-LIQUID INTERFACE OF LIQUID-SUBMERGED SUBSONIC AND SONIC GAS JETS RELATIVE TO FISSION-GAS JET IMPINGEMENT IN LMFBR SUBASSEMBLIES. Chawla, T. C. (Argonne National Lab., Ill. (USA)). Mar 1974. Contract W-31-109-eng-38. 54p. Dep. NTIS $4.00.

The analysis of the stability of the gas-liquid interface of subsonic and sonic gas jets submerged in a liquid is of primary importance for the determination of the rate of liquid entrainment and the size of the droplets formed. The determination of these quantities is required in formulating a correlation for the heat-transfer coefficient in the spray-cooled region of the fission-gas jet impingement in LMFBR subassemblies. The motion of gas in subsonic and sonic gas jets is described by linearized compressible potential flow theory with negligible shear at the gas-liquid interface; the conditions of the applicability of the linearized equations of motion are also given. The motion of the surrounding liquid is assumed to be described by linearized incompressible-flow equations. It is reasoned that this assumption is compatible with the conditions and configuration pertaining to fission-gas release in LMFBR subassemblies from a nonvented fuel pin at its end of life. The analysis shows that for the case of subsonic gas jet the pressure perturbation exerted by gas phase on the liquid layer at the gas-liquid interface is in phase with the wave amplitude and transfers energy to the liquid layer predominantly through a "lift" component or by sucking in at wave crests and pushing out at wave troughs. In case of sonic gas jet, the pressure perturbation is always out of phase with the wave amplitude; the phase angle is shown to be a function of the flow and instability parameters. Consequently, depending upon the value of phase angle, the energy to the liquid layer may be transferred both through wave-drag and "lift" components of the pressure perturbation. The analysis shows that in case of sonic gas jet, pressure perturbation becomes in phase with wave amplitude at and above the cutoff wave number which only exists for very low viscosity liquids due to stabilizing effect of surface tension; for liquids having finite or very high viscosity, the pressure perturbation is always out of phase with the amplitude, and the liquid layer is always unstable. For a subsonic gas jet, there always exists one cutoff wave number below which the disturbance is unstable; in contrast to a sonic gas jet, the cutoff wave number is not altered by the presence of viscosity. The analysis further shows that maxima exist in the distributions of the amplification factor of the disturbances at the gas-liquid interface as a function of wave number for both subsonic and sonic gas jets. For low viscosity liquids, these maxima are functions of the density ratio of gas to liquid. For liquids of large viscosity, however, the viscosity is the governing parameter. (auth)

11851 (BNWL-tr-99) DESIGN STUDIES OF LARGE FAST BREEDER REACTORS (CORE DESIGN). Nakagawa, H. Translated from Nippon Genshiryoku Gakkaishi; 15: No. 7, 469-478 (1973). 30p. Dep. NTIS $4.50.

In order to investigate the problems concerning the large fast breeder reactor, subjects relating to their design studies and to particular problems in core design are presented. These studies represent the results of the joint research in major Japanese nuclear energy companies and the Tokyo Electric Power Company. They include the design dimensions of the large fast breeder reactor (FBR), design of regular circular cylindrical reactor cores, the Pu growth rate of the two-domain reactor cores, output power density of the fuel rod, hot spot factor, design of properties of the control rod, properties of vented reactor cores, an optimum design of reactor cores, bench test concerning reactor calculation, and nuclear characteristics relating to nuclear fusion. (auth)

11852 (BNWL-tr-117) EXPERIMENTAL INVESTIGATIONS INTO COOLANT CROSS-MIXING AND PRESSURE DROP IN MULTI-ROD BUNDLES WITH HELICAL-TYPE SPACERS. Influence of the Results on the Design of Fuel Elements for Sodium-Cooled Fast Breeder Reactors. Hoffmann, H. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Dec 1973. Translation of KFK-1843. 116p. Dep. NTIS $9.00.

The core elements of a fast breeder reactor consist of triangularly arranged rods within a hexagonal shroud. Helical type spacers (helical wires, helical fins) can be used to support these rods. The thermodynamic and hydrodynamic behavior of such multirod-clusters were investigated for characteristic spacer arrangements mainly differing from each other by the spacer type, the helical spacer lead, and the number of spacers per rod. An optimum bundle geometry was selected, which was characterized by the fact that for a given maximum allowable canning temperature, the mean coolant outlet temperature of the bundle should be as high as possible and the axial pressure drop as low as possible. The thermodynamic and hydrodynamic calculations were carried out with the MISTRAL-II code. The calculational procedures call for characteristic values for coolant cross-mixing and pressure drop which were determined experimentally on the rod and spacer arrangements provided. For these experiments, 61-rod clusters were used with the specific dimensions of the fuel element of the sodium-cooled fast breeder reactor SNR-300. The comparisons of the calculational results show that within the rod and spacer configurations under consideration, rods with 3 integral helical fins as spacers are a very useful solution in realizing multirod-clusters with optimum characteristics. (GE)

11853 (EURFNR-1134) FAST BREEDER PROJECT. Third Quarterly Report, 1973. Hueper, R. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Dec 1973. 193p. (EUR-4971). Dep. NTIS $12.75.

Work performed under United States–Euratom Fast Reactor Exchange Program.

Information on the development of the LMFBR in the German Federal Republic is presented concerning fuel rod and materials development, reactor physics, and reactor safety. (DCC)

11854 (EURFNR-1169) FAST REACTOR PROGRAMME. Fourth Quarter 1973 Progress Report. Hoekstra, E. K. (comp.). (Stichting Reactor Centrum Nederland, Petten). Feb 1974. 74p. (RCN-207). Dep. NTIS (US Sales Only) $6.75.

Work performed under United States–Euratom Fast Reactor Exchange Program.

Results are given of spectrum and fission product reactivity measurements performed in the STEK reactor core 500. Data obtained from out-of-pile isothermal burst tests on tubes of material Sandvik 12R72HV are discussed. The temperature history of the sodium along the fuel pin during loss-of-cooling experiment L08 is given. Results from this experiment are compared with those of the L05 performed earlier. Progress is reported on lattice parameter, thermodynamic and thermal expansion measurements on U(C,N). Data on carbide precipitation and hardness increases in plate material of austenitic steel 1.4948 resulting from heat treatments from 550°C to 900°C during periods up to 1800 hrs and results of stress relief experiments on weldings are furnished. A model of the behavior of an enclosed aerosol in condensing vapor is described and results of the Gold-rush experiments elucidated. Single-phase heat transfer and temperature noise measurements in a sodium-cooled 12-rod bundle experiment, the calculation of heat transfer development in bundles and the fabrication and testing of heaters are discussed; hot spot calculations on a gas-cooled breeder core using a new version of the code SHOSPA are reported. (auth)

11855 (FRA-TM-62) USER'S MANUAL FOR THE REACTOR BURNUP SYSTEM, REBUS-2. Olson, A. P. (Argonne National Lab., Ill. (USA)). 1 Mar 1974. 231p. Dep. NTIS $14.75.

A user's manual for the REBUS-2 System (REactor BUrnup System) is presented. The primary purpose is to provide sufficient information about the REBUS-2 capability to ensure its efficient utilization. The current REBUS-2 System either solves for the infinite time (equilibrium) operating conditions of a recycle system under fixed conditions, or solves for the operating conditions during a sequence of time steps (non-equilibrium). The capability of studying various in-reactor fuel management and ex-reactor fuel management schemes has been included. REBUS-2 has been operated with one- and two-dimensional diffusion theory neutronics solutions up to the present time. The model was specifically designed for extension to other neutronics models such as three-dimensional diffusion or transport theory and direct or synthesis solutions. (auth)

11856 (IAEA-154) GAS-COOLED FAST REACTORS. Proceedings of the IAEA Study Group Meeting, Minsk, Byelorussian, July 24–28, 1972. (International Atomic Energy Agency, Vienna (Austria)). 1973. 382p. (In English and Russian). (CONF-720739-).

Separate abstracts were prepared for each of the 16 papers included. (JWR)

For abstracts of individual papers see: 10271, 11857–11868, and 11948–11950.

11857 (IAEA-154, pp 21-61) GAS-COOLED BREEDERS AS AN ALTERNATIVE TO LMFBR's. Hard and Soft Neutron Spectra. Feinberg, S. M. (Inst. of Atomic Energy, Moscow). 1973. (In Russian).

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

Two possible trends in the development of fast breeders are described. A primary characteristic of each type is the small doubling time, or the order of 3 to 5 years. The first possible trend discussed is the use of a "Pu" active zone with hard neutron spectrum and high value of the breeding ratio (≈2). In the second alternative a diluted active zone is considered with longitudinal-transverse movement of the gas in micro fuel element cassettes. It has a very low breeding ratio (≈1.6), but a very high specific power rating of the fuel. (tr-auth)

11858 (IAEA-154, pp 63-78) GULF GENERAL ATOMIC GAS-COOLED FAST BREEDER REACTOR SYSTEM. Fortescue, P. (Gulf General Atomic Co., San Diego, CA). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The basically important features of helium as a medium for fast reactor cooling and their influence on reactor design are first discussed. The essential conclusion is that helium can indeed provide cooling adequate to achieve the highest useful fuel ratings; furthermore, with helium, the serious thermal-shock problems associated with the extreme heat-transfer properties of liquid metals are avoided. Other favorable features of helium that particularly influence safety, maintenance, and capital cost are also enumerated. Following a statement of ground rules and objectives, the design of a 300-MW(e) GCFR Demonstration Plant is summarized and then the principal features of this design that particularly characterize it, and the reasons for their being selected, are discussed. Tables listing the performance of the GCFR demonstration plant and that of a projected 1000-MW(e) prototype are included. On the comparative basis of operation only at hot-spot temperatures presently projected for LMFBR fuel (700°C), a fuel rating of 1 MW(t)/kg of fissile material is obtained as well as a conversion ratio of 1.45. The conclusion is that even with no allowance for eventual higher temperature operation, a gas coolant can provide all the cooling a fast breeder reactor needs, and in so doing, it also uniquely provides a very high breeding gain. Furthermore, many practical engineering problems associated with liquid metal systems, particularly in the areas of safety and maintenance, are considerably eased with a gas-cooled system. (auth)

11859 (IAEA-154, pp 79-88) PAST AND FUTURE PROGRAMMES OF THE GBR ASSOCIATION. Chermanne, J. (Belgonucleaire, Brussels). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The program of the European Association for Gas Breeder Reactor (GBR Association) is described. As this program is complementary to other European efforts going on, the background and environment are briefly discussed. (auth)

11860 (IAEA-154, pp 89-101) GAS-COOLED FAST REACTORS WITH DISSOCIATING GASES. Krasin, A. K. (Inst. of Nuclear Energy, Minsk). 1973. (In Russian).

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

Technical and economic aspects of the feasibility of reactors using N_2O_4 as the coolant and working substance for the turbines were discussed. The physical and thermal characteristics of these 1000 MW(e) fast Pu reactors are tabulated. The doubling time and the unitary power are calculated. The safety guarantees and the operating standards are summarized. Capitalization of the plant and the energy cost are discussed. (JSR)

11861 (IAEA-154, pp 103-126) PHYSICAL AND TECHNICAL CHARACTERISTICS OF DISSOCIATING N_2O_4 AS A COOLANT FOR FAST POWER REACTORS. Nesterenko, V. B. (Inst. of Nuclear Energy, Minsk). 1973. (In Russian).

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

Experimental data on the thermal and physical characteristics of N_2O_4 were reported. These data were used to calculate the thermal scheme for heat conversion and the instrument parameters for a fast power reactor using N_2O_4 as a coolant. The results of the thermal-physical, gas dynamic, and physical calculations are tabulated. The U needs for such a reactor and the necessary development time were considered. Development required for the construction of these reactors was indicated. (JSR)

11862 (IAEA-154, pp 127-134) INTERNATIONAL CO-OPERATION IN GAS-COOLED FAST REACTOR DEVELOPMENT WITHIN THE OECD NUCLEAR ENERGY AGENCY. Boxer, L. W. (Nuclear Energy Agency, Paris). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The framework, objectives, and accomplishments of the NEA sponsored gas-cooled fast reactor program are discussed. (JWR)

11863 (IAEA-154, pp 135-166) DESIGN STUDY OF He GAS-COOLED FAST BREEDER REACTOR. Mochizuki, H.; Kobayashi, Y.; Tanaka, R.; Izaki, T.; Matsuki, Y.; Watanabe, T.; Takitani, K.; Ooka, T.; Kobayashi, T.; Koike, H. (Kawasaki Heavy Industries, Tokyo). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

Work on the 1000 MW(e) GCFBR has been carried out by Kawasaki Heavy Industries Ltd. continuously since 1967. Since 1970, the effort has been focussed to the He gas-cooled fast breeder with pin type mixed oxide fuel and indirect steam cycle. At present work on primary system and safety is in progress. Fuel pin diameter, reactor core height, coolant flow area ratio, and blanket thickness were the design parameters used in estimating nuclear performance and fuel burnup characteristics. Two-dimensional burnup calculations were executed including two-batch refueling. The optimization was processed considering fissile Pu inventory, doubling time, and fuel cycle cost. (auth)

11864 (IAEA-154, pp 167-190) DESCRIPTION OF GBR REFERENCE DESIGNS. Chermanne, J. (Belgonucleaire, Brussels). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The description of the different GBR reference plant designs is made with comparison between the pin and coated particle types of reactors. (auth)

11865 (IAEA-154, pp 191-234) PHYSICS AND ENGINEERING OF PLANTS WITH LARGE GAS-COOLED FAST BREEDER REACTORS. Ponomarev-Stepnoi, N. N.; Glushkov, E. S.; Grebennik, V. N.; Demin, V. E.; Khrulev, A. A. (Inst. of Atomic Energy, Moscow). 1973. (In Russian).

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The basic problems affecting the construction of economic fast reactors with small doubling time are considered. These include the selection of the gaseous coolant, the type of fuel elements (plates, spherical microelements, and rods), and reactor power. The economic feasibility of reactors with multiplutonium zones is briefly discussed. The advantages and disadvantages of the reactor plans discussed are considered. (JSR)

11866 (IAEA-154- pp 235-256) ALTERNATE ENERGY CONVERSION SYSTEMS IN GCFR POWER PLANTS. Sarlos, G. (Swiss Federal Inst. for Reactor Research (EIR), Wuerenlingen). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The results of a comparative study are presented here concerning different energy conversion systems with a He cooled fast breeder reactor. Designs using gas turbines in a direct cycle are compared with the indirect steam cycle. The main criteria used for this comparison are the plants' economic, safety, and engineering aspects. (auth)

11867 (IAEA-154, pp 267-288) GAS-BREEDER MEMORANDUM AND THE RESEARCH AND DEVELOPMENT PROGRAMME OF THE FEDERAL REPUBLIC OF GERMANY IN THE FIELD OF GAS-COOLED FAST REACTORS. Dalle Donne, M. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The history of international cooperation in the development of gas cooled fast breeder reactors is briefly reviewed. The studies by the Karlsruhe and Juelich groups on the feasibility and economics of a GCFR which led to the gas breeder memorandum are discussed. Current activities on GCFR development in the German Federal Republic are described. (JWR)

11868 (IAEA-154, pp 367-380) GCFR FUEL ASSEMBLIES. Chermanne, J. (Belgonucleaire, Brussels). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

Fuel assemblies for GCFRs proposed by the GBRA are described. One assembly uses vented pins clad in stainless steel and cooled by helium. This assembly is similar to that of an LMFBR but the clad temperature is slightly higher, the pin internal and external pressures are equalized, and the clad is provided with external roughening to improve heat transfer. The other assemblies use beds of coated fuel particles directly cooled either by helium or by carbon dioxide; they allow gas temperatures similar to those of HTR or AGR but with relatively low coated particle temperatures. (auth)

11869 (JAPFNR-151) PROGRESS REPORT ON FAST BREEDER REACTOR DEVELOPMENT IN JAPAN. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Feb 1974. 8p. (PNC-N-251-74-6). Dep. NTIS (US Sales Only) $4.00.

The activities described include construction of JOYO, design of MONJU, reactor physics experiments, component and equipment development, instrumentation and control development, sodium technology research, fuels and materials development, reactor safety research, and steam generator development. (JWR)

11870 (KFK-1273-1) FAST BREEDER PROJECT. 1st Quarterly Report, 1973. (Kernforschungszentrum Karlsruhe (F.R. Germany). Projekt Schneller Brueter). Jun 1973. vp. (In German). (EUR-4968). INIS.

Some of the important items in the project which are discussed are fuel pin development, material studies and development (cladding tubes of the fuel pins irradiated in the Mol 7A experiment were tested for creep rupture and tensile tests); corrosion tests and coolant analyses; physics (methods of determining the fission rate, influence of control rods on the power distribution in the core of the SNR-300); safety and instrumentation (noise measurements performed on the KNK reactor); technology (influence of stress upon the sliding behavior of materials, thermodynamical and fluid dynamical core design, high performance heater rods for safety experiments, hydraulic tests in the SNR absorber bundle, and hypothetical incidents in steam-cooled fast reactors). (GE)

11871 (ORNL-TM-4592) FAST REACTOR EXPERIMENTAL SHIELDING PROGRESS REPORT FOR JANUARY 1974. 189a No. 10028, Activity No. HN 04 01 01 1. Clifford, C. E.; Muckenthaler, F. J.; Stevens, P. N.; Freestone, R. M. Jr. (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W-7405-eng-26. 45p. AT.

Work performed by the ORNL Neutron Physics Division in the Fast Reactor Experimental Shielding Research during the month of January, 1974 is described. Additional FTR and Demo-Plant first-fission measurements were made because of a significant disagreement between earlier measurements and calculated results. Measurements were taken with several ^{235}U fission counters, a bare and Cd-covered BF_3 counter, and the 3-in. Bonner ball. A more comprehensive set of shield configurations were analyzed with two of the configurations being duplicates of experiments conducted during August and September 1973. Care was taken to ensure that the effects of reflected low-energy neutrons from either the ground or the air in back of the shield were eliminated. The new results were found to agree to within about 10 percent for the two configurations run earlier. (auth)

11872 (RD/B/N-2905) SHAKEDOWN OF STRUCTURES AT HIGH TEMPERATURE. Townley, C. H. A. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1974. 14p. (CFR/DCWG-(74)46). Dep. NTIS (US Sales Only) $4.00.

The shakedown concept has been used extensively in the design of structures operating at moderate temperature to decide the maximum level of local stress which can be permitted in discontinuity regions. How far the shakedown concept can be developed to include structures where time dependent creep effects modify the stress pattern is examined. A comprehensive study would require elastic-plastic-creep-cyclic calculations on a wide variety of structures under various loading techniques and at various temperatures. However, much useful information can be derived by considering three extreme types of loading systems and by making pessimistic assumptions about how typical structures will respond. The maximum permitted local stress level obtained from such analysis is considerably higher than that permitted by the ASME Code Case 1331-8 in the temperature range which is most important in the design of fast reactor components. (auth)

11873 DENSIFICATION IN MIXED OXIDE FUEL DURING FAST REACTOR IRRADIATION. Carlson, M. C. J. (Westinghouse Hanford Co., Richland, WA). Nucl. Technol.; 22: No. 3, 335-359(Jun 1974).

Densification of mixed oxide fuel in Liquid Metal Fast Breeder Reactor (LMFBR) during irradiation is demonstrated to be predictable through knowledge of original pore size distribution which is controllable in fabrication. Quantitative measurements of pore size distributions before and after irradiation cover the range of fuel structure and irradiation conditions typical of the Fast Flux Test Facility (FFTF). Pore diameter change is accurately described by: $\Delta D = -(4.37 \pm 0.49) \times 10^{-5}\, I;\ \Delta D = +(9.45 \pm 0.62) \times 10^{-13}\, I^2\, T$ in the range 1000°K < T < 1450°K and to 30,000 MWd/MTM, the current extent of test burnup, I. Fuel column length change due to in-reactor sintering will be <1.3% in FFTF. (auth)

11874 EXPERIMENTAL MIXING STUDIES IN SIMULATED WIRE-WRAP FUEL ASSEMBLIES. Ginsberg, T.; Lorenz, J. J.

(Argonne National Lab., IL). pp 13-38 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The results are presented of ANL-CTD efforts to develop an experimental procedure for acquisition of reliable mixing data in helical-wire spacer systems. The experimental procedure is described, and the results of tracer mixing studies using 7-pin triangular geometry are presented. The results are interpreted to give a reasonably complete description of the transport processes in a 7-pin test-section, and the data is compared with two of the available lumped-parameter computer codes, COBRA-IIIB and SWEEP. Finally, test plans for a 91-pin test series are discussed. 17 references. (auth)

11875 EXPERIMENTAL DETERMINATION OF THE LOCAL TRANSVERSE MIXING IN A ROD BUNDLE WITH HELICAL WIRE SPACERS. Bolle, L. (Univ. Catholique, Louvain, Belgium); Wauters, P.; Mestrez, J.; Michel, A. pp 39-53 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The flow of a coolant in a fuel rod bundle with helical wires as spacers is described. The mixing rate between adjacent subchannels is evaluated locally, both in the central and in the peripheral region of the assembly. An experimental investigation has been performed with the aid of a high scale model, which was geometrically similar to a six-rod fraction of the blanket region of a fast breeder reactor. Air was used to simulate the coolant. 11 references. (auth)

11876 INFLUENCE OF THE ROUGHNESS SHAPE ON THE THERMOHYDRAULIC CHARACTERISTICS OF RIBBED SURFACES. Hudina, M. (Swiss Federal Inst., Wuerenlingen, Switzerland). pp 111-133 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The thermohydraulic characteristics of rough surfaces depend generally upon the channel geometry, the Mach number, the Prandtl number, the Reynolds number and the characteristic dimensions and shape of the roughness. In the experimental programme ROHAN the influence of the different roughness shapes was investigated. These experiments covered a relatively wide range of Reynolds numbers from normal operating conditions, through the part load, down to the depressurized reactor situation. 14 references. (auth)

11877 THERMAL HYDRAULIC MULTICHANNEL ANALYSIS. Sha, W. T. (Argonne National Lab., IL); Goldner, F. J.; Huebotter, P. R.; Shmitt, R. C. pp 180-210 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Some recent results obtained by the THI3D computer program for a typical LMFBR fuel assembly are presented. It is believed that these results represent the first time that a rigorous code such as THI3D was employed in the temperature mapping of a 217-pin LMFBR fuel assembly. A brief summary of the mathematical model is presented. Numerical results are presented. The implications of these numerical results and some suggestions of the future work in this area are discussed. 17 references. (auth)

11878 AXIAL DEVELOPMENT OF TEMPERATURE FIELDS IN HEXAGONAL FAST REACTOR FUEL ROD ASSEMBLIES WITH LIQUID METAL COOLING. Nijsing, R.; Eifler, W. (EURATOM, Ispra, Italy). pp 252-280 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Predictions are presented for three dimensional temperature distributions in small regions of hexagonal fast reactor fuel rod assemblies cooled by a turbulent flow of liquid metal. Attention is focussed on the coolant region within a single subchannel in the interior of the bundle and on that surrounding a fuel rod adjacent to the assembly duct wall. The latter region is of particular interest for thermal design, since the non-uniformity in geometry and flow conditions at the circumference of wall-adjacent fuel rods may provoke important circumferential cladding temperature variations, causing excessive thermal stresses or leading to rod bowing. This problem is aggravated by the phenomenon of "swelling" which in order to be accommodated, may require larger rod-wall clearances in the initial period of reactor operation. 19 references. (auth)

11879 EXPERIMENTAL STUDY ON HEAT TRANSFER IN LONG, SUBCRITICAL ONCE-THROUGH STEAM GENERATORS. Campolunghi, F. (CNEN, Rome); Cumo, M.; Ferrar, G.; Leo, R.; Vaccaro, G. pp 373-403 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

In long, once-through steam generators (like LMFBR types) with very high L/D values and relatively low surface heat flux values, the usual well fit burnout correlations, deduced for reactor core reference situation (low L/D ratio and high surface heat fluxes), show sensible errors and may not be directly applied. Two separate pressure ranges do appear, delimited by $p/p_{cr} < 0.4$ and $p/p_{cr} > 0.5$, in which burnout qualities are substantially different and two different burnout mechanisms seem to exist. At pressures $120 < p < 160$ kg/cm^2 Becker correlation fits experimental data quite well. 12 references. (auth)

11880 TWO-PHASE FLOW EXPERIMENTS IN A 10 m LONG SODIUM HEATED STEAM GENERATOR TEST SECTION. de Munk, P. J. (CTI-TNO, Apeldoorn, Netherlands). pp 504-518 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

As a basis for the once-through steam generator design for Liquid Metal Fast Breeder Reactors a sodium-heated single-tube experiment is being performed in the so-called SWISH-loop at the Central Technical Institute TNO. The experiment is also meant as an aid in interpreting and evaluating the full-scale steam generator tests in the 50 MW Sodium Component Test Facility in Hengelo. All relevant thermohydrodynamic problems of the evaporator section of once-through straight tube sodium heated steam generators are being studied. (auth)

11881 FLOW PATTERN, TWO-PHASE PRESSURE DROP, AND CRITICAL HEAT FLUX OF SODIUM UNDER FORCED CONVECTION CONDITIONS. Kaiser, A.; Peppler, W.; Voeroess, L. (Kernforschungszentrum, Karlsruhe, Ger.). pp 637-660 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

Within the scope of the research of the behavior of cooling disturbances in fast reactor subassemblies basic experiments with respect to the two-phase flow regime of sodium were performed. The two-phase pressure drop and the annular film thickness were measured up to the critical cooling conditions. The measured values were compared with values predicted by models known from the literature with special emphasis on Levy's model. (auth)

11882 DIRECT CONTACT HEAT TRANSFER IN A MOLTEN SALT FAST BREEDER REACTOR. An Experimental Study Using Analogue Fluids. Ralph, J. C. (Atomic Energy Research Establishment, Harwell, Eng.). pp 704-727 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The rate of heat transfer between a dispersed heavy metal liquid in direct contact with water in turbulent co-current flow down a vertical pipe was found to be high. Typical mid-range values of volumetric heat transfer coefficient were around 3 Mw/m^3 °C. A clear dependence of the volumetric heat transfer coefficient on both the water velocity and the flow ratio of metal to water was observed. Approximate relationships between the volumetric heat transfer coefficient and flow rates indicated a slower increase of heat transfer coefficient with packing fraction than that predicted by available theoretical treatment. Pressure drop measurements indicate that the vertical flow of mixtures of the type tested can to a first approximation be treated as homogeneous mixtures provided due account is taken of the slip between components. Brief separation tests suggest rapid stratification in horizontal flow even under very turbulent conditions. 11 references. (auth)

11883 HEAT TRANSFER IN THE IMPINGEMENT AREA OF A GAS JET, SUBMERGED IN LIQUID METAL AND STRIKING A HEATED SURFACE. Wilson, R. E.; Chawla, T. C.; van Erp, J. B. (Argonne National Lab., IL). pp 747-768 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The study of a gas jet, impinging on a heated surface, while submerged in a liquid metal is presented with the aim of evaluating the potential for pin-to-pin failure propagation due to fission gas release in fuel subassemblies of liquid metal cooled fast breeder reactors (LMFBRs). Though the particular configuration of the test section used in the present study was chosen with the above objective in mind, it is felt that the data may be of wider interest, and be of importance in other areas of technology. 12 references. (auth)

11884 SABRE CODE FOR PREDICTION OF COOLANT FLOWS AND TEMPERATURES IN PIN BUNDLES CONTAINING BLOCKAGES. Gosman, A. D. (Imperial Coll. of Science and Tech., London); Herbert, R.; Patankar, S. V.; Potter, R.; Spalding, D. B. pp 769-783 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

A new computer code is described for analyzing flow blockage conditions. Its name is SABRE and it has been developed at Imperial College under the terms of a contract between UKAEA, Winfrith and Combustion, Heat and Mass Transfer Ltd, (CHAM). The SABRE code represents the adaptation to pin-cluster geometry of a general method for calculating steady and unsteady flows in three-dimensional continua, with non-uniformities of fluid properties, sources and distributed resistances. The method is iterative and implicit and it employs non-uniform rectangular grids with velocity nodes interspersed between the nodes at which pressure and temperature are computed. 8 references. (auth)

11885 TEMPERATURE DISTRIBUTION IN THE RECIRCULATING FLOW DOWNSTREAM OF LOCAL COOLANT BLOCKAGES IN ROD BUNDLE SUBASSEMBLIES. Kirsch, D. (Kernforschungszentrum, Karlsruhe, Ger.). pp 784-804 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The possible propagation of a fault initiated by a local coolant blockage is one of the problems which are considered with safety investigations for liquid-metal cooled fast breeder reactors (LMFBRs). Such a blockage may arise from an accumulation of fuel particles or other coolant impurities at a spacer grid of a fuel subassembly. In order to evaluate the coolant temperature rise close to such blockages, flow and temperature distributions downstream of simulated local blockages have been investigated. 11 references. (auth)

11886 LOCAL BOILING IN THE FAST REACTOR SUBASSEMBLY ENVIRONMENT. Brook, A. J. (United Kingdom Atomic Energy Authority, Culcheth, Eng.). pp 805-829 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F. R. Germany (9 Oct 1973). See CONF-731020-.

The transition from local boiling to full scale bulk boiling in an LMFBR is examined by analyzing the development and behavior of single bubbles in the reactor environment. 10 references. (auth)

11887 USE OF CORE CATCHERS IN FAST REACTORS. Peckover, R. S. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). pp 830-850 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

A temperature excursion arising through some hypothetical blockage of the cooling system in a liquid cooled reactor system could lead to the meltdown of the core or some part of the core. If the molten core comes into contact suddenly with the coolant a rapid transfer of energy may occur from fuel to coolant via an FCI. In order to prevent failure of the reactor vessel, suitably designed core catchers are placed below the core to catch the molten debris. The overall effectiveness of a core catcher, or an array of core catchers, in cooling the hot core debris depends upon the catchers being able to catch and hold the core initially, and subsequently upon the heat transfer within the core material, the catchers and the coolant being sufficient to avoid the boiling and dispersal of the core material. The heat transfer characteristics are described for a single catcher holding a mass of collapsed core in an isothermal sea of coolant, concentrating especially on a slab model. The effectiveness of convection in the coolant as a heat transporting mechanism both for a single catcher and an array of catchers is analyzed. 36 references. (auth)

11888 DESIGN STUDIES OF LARGE FAST BREEDER REACTORS. Core Design. Nakagawa, H. (Tokyo Electric Power Co. Inc.). Nippon Genshiryoku Gakkaishi; 15: No. 7, 469-478(Jul 1973). (In Japanese).

The core design for a large fast breeder reactor was studied. The outline of the 1000 MW(e) class core design is introduced, and some problems peculiar to large reactor cores are clarified on the columnar form of the core, plutonium enrichment rate of two region core structure, power density of fuel pins and the hot spot factor, design of control rods, optimum design of a reactor core, bench mark tests and nuclear characteristics of burn-up. The most important problem of large reactors is the countermeasure to the positive void coefficient of reactivity. In this design, the columnar core height of 110 ~ 120 cm and D/H = 3 ~ 4 were used, taking the study by the U.S. AEC into consideration. Plutonium enrichment rate was decided on the basis of the optimum enrichment ratio which provides a minimum peaking factor. A relatively large value was selected for a hot spot factor. The maximum permissible line power output was low (215 ~ 230 W/cm). Two independent control rod systems were employed, and they can independently shut down the reactor. The fuel pins were vent type, and the sodium outlet temperature can be raised by 20 ~ 30°C. The thickness of the blarket, and specifications of the fuel pins, were decided using an optimum core design code system for fast breeder reactors. Because of the uncertainty of existing nuclear constant set, design values involve the uncertainty of several percent. (JA)

Research, Test, and Experimental Reactors

Refer also to abstracts 11343 and 11837.

11889 (ANCR-1137) FACILITY OPERATING MANUAL: LOW POWER TEST FACILITY. Kunze, J. F.; Chase, P. L. (Idaho Nuclear Corp., Idaho Falls (USA)). Dec 1970. Contract AT(10-1)-1230. 85p. Dep. NTIS $7.25.

The Facility Operating Manual for the Low Power Test Facility is a general descriptive manual of the reactor operating systems and the related support equipment and utilities. Appropriate operating procedures for the permanent equipment, general personnel requirements, and reactor operating rules and regulations applicable to all reactors at LPT are included. (auth)

11890 (ANL/EBR-83) CONTROLS FOR EBR-II PRIMARY-TANK HEATERS. Napper, D. H.; Moriarty, K. J. (Argonne National Lab., Ill. (USA); Argonne National Lab., Idaho Falls, Idaho (USA)). Mar 1974. Contract W-31-109-eng-38. 20p. Dep. NTIS $4.00.

"Zero-crossover" SCR (silicon-controlled rectifier) controllers for the EBR-II primary-tank heaters were installed to reduce electrical-noise generation caused by the original "phase-fired" SCR controllers. The system consists of six controllers and heaters rated at 112 kW each with a three-phase, 480-V power supply; two heaters and controllers are on each phase. One of the controller-heater pairs (W5) is limited automatically to 70 kW because of the closeness of the heaters to the primary-tank wall. Higher power could cause undue stress in the tank wall. The heaters can be controlled separately or collectively from the EBR-II control room, or separately via local controls in connection with a permissive control function in the control room. Individual and total heater powers are indicated in the control room, and individual heater power is indicated locally at each heater controller. (auth)

11891 (CNAEM-R-114) IRRADIATION FACILITIES IN AND AROUND THE TR-1 REACTOR CORE. Oener, O. D. (Cekmece Nuclear Research Center, Istanbul (Turkey)). 1973. 16p. Dep. NTIS (US Sales Only) $4.00.

At the present time two sample guide tubes, two dry tubes, one irradiation rig, one graphite reflector element and one control fuel element are in use in TR-1 core as irradiation facilities. Beside these and the stringers used for flux measurements, a fast flux irradiation facility, a sealed container and a milk-can facility are available if required. Experimental facilities built with the reactor and the equipment mounted in and on these are presented. All other facilities, with the exception of built-in facilities and the diffractometer, have been designed by the reactor operation Group and manufactured in Cekmece Nuclear and Training Center. Emphasis has been placed on design and construction as well as utilization and experience. Dimensions and flux values may be considered specific for local users; however, comments on design ex-

perience and discussions related to core configurations may be of value to similar small-facility operators and users. (10 references) (auth)

11892 (COO-3019-8) SEMIANNUAL PROGRESS REPORT, JANUARY 1–JUNE 30, 1973. First, M. W.; Goldin, A.; Hall, R. R.; Underhill, D. W.; Moeller, D. W. (Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.). Dec 1973. Contract AT(11-1)-3019. 50p. Dep. NTIS $5.50.

A hermetic gas booster was tested on a prolonged sodium oxide and sodium metal aerosol load. The blower performed well under the tested conditions and was capable of maintaining a flow of 1400 SCFM at over 30 inches of water gauge. When switching from low to high speed, a gas flow control valve must be closed or the flow will exceed 1700 SCFM and the fan will be overloaded. The amount of sodium deposited in the 8 and 12 inch diameter ducts leading to and from the blowers was determined. These results give better data than can be predicted by theory. Studies of the adsorption of krypton and xenon from argon were extended to low partial pressures of argon to determine the shape of the curve of adsorption coefficient vs. argon loading of charcoal at low loadings. It was found that the fall-off of adsorption was extremely rapid even with very low loadings. The adsorption of the fission noble gases from nitrogen was also studied. General trends were similar to those noted in adsorption from argon and numerical values were not markedly different. The Polanyi adsorption theory was found useful in explaining the results from both argon and nitrogen. Adsorption from air and from a 60:20:20 mixture of nitrogen-argon-oxygen was substantially the same as for nitrogen. The effect of decay heat on the operation of a fission gas holdup bed was examined using a one dimensional model which is valid for the case of a small temperature increase. The effects of axial and radial heat conduction, convection, and radiodecay on bed temperature were taken into account in both the analytical solution and the numerical analysis. An important conclusion is that a significant temperature rise can result from a fairly small, but constant, input of fission gas. (14 references) (auth)

11893 (HEDL-TME-74-1(Vol.3)) HEDL QUARTERLY TECHNICAL REPORT, JANUARY–MARCH 1974. Volume 3. Engineering and Development. Noordhoff, B. H.; Weber, S. A. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Apr 1974. Contract AT(45-1)-2170. 103p. AT.

The testing of FFTF components and equipment is described. The development of measurement and control systems is reviewed. The fabrication of FFTF components is summarized. Test program engineering data and measurement and control data are presented in appendices. (auth)

11894 (JUL-983-RE) PRESENT AND FUTURE UTILIZATION OF THE RESEARCH REACTORS FRJ-1 (MERLIN) AND FRJ-2 (DIDO) OF THE KERNFORSCHUNGSANLAGE, JUELICH. Fassbender, J.; Muench, E.; Nutbohm, D.; Thamm, G. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Forschungsreaktoren). Jul 1973. 98p. (In German). Dep. NTIS (US Sales Only) $8.00.

The tasks of the two reactors are discussed with a view to finding feasible ways of reducing the operating costs. Of particular interest is the question of what consequences will arise for the research and development program of the KFA from a possible cutdown of operation or even complete shut-down of the FRJ-1, and the retrenchment to be achieved by this measure. The results of this study show that the two reactors are well utilized and that the reduction of expenses to be achieved by these measures would be out of all proportion to the loss of experimental capacity and the consequences associated with it. (GE)

11895 (JUL-1014-RE) EXTENSION OF THE FOUR STANDPIPES IN THE TANK OF THE RESEARCH REACTOR FRJ-2 AS AN EXAMPLE OF THE PERFORMANCE OF COMPLICATED TASKS IN AREAS WITH HIGH RADIATION LEVELS. Nickel, M.; Schmitz, J.; Wolters, J. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany). Zentralabteilung Forschungsreaktoren). Nov 1973. 43p. (In German). Dep. NTIS (US Sales Only) $5.25.

As a result of the planned power increase from 15 MW to 25 MW, a new emergency cooling system had to be installed in the research reactor FRJ-2 of the KFA Juelich, which called for an extension of the four standpipes in the reactor tank by 57 mm. Due to the high radiation level in the reactor tank, new techniques had to be found for welding aluminum rings of corresponding height to the top part of the standpipes by remote-control. The welded parts were then protected by a bandage made of high-quality steel. An account of the techniques applied and the results obtained is presented. (GE)

11896 (KFK-1705) OPERATION OF THE RESEARCH REACTOR FR2 IN 1971. Steiger, W.; Moeller, I. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Reaktorbetrieb und Technik). Nov 1973. 180p. (In German). INIS.

The ten phases of operation (each of four weeks duration except for operating phase B of three weeks duration) proposed in the schedule for the heavy-water moderated research and material test reactor FR2 were largely adhered to in 1971, while achieving a nominal power of 44 MW. During each phase, the reactor was operated about 30 days and shut down for five days for fuel element loading and unloading, withdrawal and installation of experiments, as well as maintenance and inspection work. The total energy produced amounted to 11,811 MWd. The burnup of the fuel elements, type BE 8, with an initial enrichment of 2% and withdrawn according to schedule was increased to more than 14,000 MWd per ton of uranium. The utilization of FR2 for experiments was the same as in 1970, since practically all experimental positions were occupied. With respect to the capsule irradiations performed within the framework of the Fast Breeder Project a marked reduction could be observed in the number of experimental rigs. New tasks related to the irradiations of fuel element plates for Physikalisch-Technische Bundesanstalt (PTB) and a thermionic emitter of the Siemens company. Of the usable beam holes, only the beam hole outlet R6 was not used. Like the previous year, five loop experiments were conducted. In the pressurized water loop a second rig was put into operation in the course of the year. As compared to previous years, the production of radioactive isotopes continued to rise. It attained the highest level so far. The reactor and test operations were performed safely with the absence of noticeable incidents and major disturbances. (GE)

11897 (KURRI-TR-110) HIGH FLUX RESEARCH REACTOR AND ITS UTILIZATION. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1972. 81p. (In Japanese). Dep. NTIS (US Sales Only) $7.25.

Twenty-one papers are included on high-flux research reactor facilities and their utilization. A separate abstract was prepared for each of 9 papers. (HDR)

For abstracts of individual papers see: 11898–11906.

11898 (KURRI-TR-110, pp 1-3) CHARACTERISTICS OF BERYLLIUM REFLECTOR. Tanaka, T. (Japan Atomic Energy Research Inst., Oarai). 1972. (In Japanese).

The characteristics of beryllium reflector used in the Japan Material Testing Reactor are described from the view points of: (i) the effect of water coolant in beryllium reflector on reactivity and moderator character, (ii) the effect of the induced poison of ^{6}Li and ^{3}He from $^{9}Be(nf,\alpha)^{6}He \rightarrow {}^{6}Li(nth,\alpha)^{3}H \rightarrow {}^{3}He$ reactions on reactivity. The practical problems in using beryllium reflector are discussed. (auth)

11899 (KURRI-TR-110, pp 15-24) EXPERIMENTS ON ENGINEERING PROBLEMS IN CONSTRUCTING KUR-2. Araki, Y.; Shibata, T. (Kyoto Univ.). 1972. (In Japanese).

The following items are investigated by the use of mock-up and scale models for constructing a high flux research reactor, (1) the strength and shape of the pressure vessel, (2) the structure and function of detachable beam tubes, covers etc., (3) hydraulic thermodynamics of core-coolant at high temperature and high pressure. (auth)

11900 (KURRI-TR-110, pp 25-28) PROBLEMS ON NEUTRON FLUX QUALITY OF RESEARCH REACTOR. Kanda, K. (Kyoto Univ.). 1972. (In Japanese).

Neutron flux quality of research reactors is discussed from the following points of view: (1) neutron flux intensity (2) neutron energy spectrum (3) size and geometry of neutron source (4) contamination (5) temperature change (6) time dependency (7) continuous operation and pulse operation (8) handling. The application of these problems for medical radiation facility is discussed. (auth)

11901 (KURRI-TR-110, pp 37-41) NEUTRON PHYSICS. Sugiyama, K. (Tohoku Univ., Sendai). 1972. (In Japanese).

A survey of earlier works concerning delayed fission neutrons is given. Emphasis is put on the study of the delayed fission neutrons and the precursor nuclides. Some facilities for the study are proposed in relation with the high neutron flux reactor. (auth)

11902 (KURRI-TR-110, pp 42-43) VIEWS OF NEUTRON PHYSICS AND RESEARCH REACTOR. Okamoto, S. (Kyoto Univ.). 1972. (In Japanese).

Research applications of neutrons are increasing, and often a high intense source of slow neutrons with a low contamination of fast neutrons and gamma-rays is required. For this purpose, the use of a neutron guide tube is proposed, which is applicable for the usual research reactors. The possibility of application of pulsed reactors and fusion reactors for neutron sources is discussed. (auth)

11903 (KURRI-TR-110, pp 44-47) NEUTRON DIFFRACTION. Kunitomi, N. (Osaka Univ.). 1972. (In Japanese).

Neutron diffraction and spectroscopy are examined for the purpose of establishing a design for using the high flux beam reactor as a strong slow neutron source. Spectrometer types which meet the requirements are proposed. (auth)

11904 (KURRI-TR-110, pp 49-52) NUCLEAR CHEMISTRY. Fujiwara, I. (Kyoto Univ.). 1972. (In Japanese).

Synthesis of transuranium elements through neutron capture in the high flux reactor is described, and isotope separators on-line with the reactor are considered, with the gas filled separator showing advantages for research of short-lived fission products. (auth)

11905 (KURRI-TR-110, pp 54-57) REQUEST OF SPECIAL FACILITIES FOR IRRADIATION STUDY. Igata, N. (Tokyo Univ.). 1972. (In Japanese).

Low and high temperature in-pile-loops have been requested for the high flux reactor to meet the growing needs for irradiation capabilities of higher total dose and wider temperature range. Some examples of irradiation facilities are shown. (auth)

11906 (KURRI-TR-110, pp 69-73) HIGH FLUX REACTOR FOR BIOLOGICAL AND MEDICAL USE. Watanabe, N. (Tokyo Univ.). 1972. (In Japanese).

Some biological and medical applications of a high flux reactor are listed together with the required neutron flux characteristics. (auth)

11907 (LA-5571-MS) ANTIMONY-BERYLLIUM NEUTRON SOURCE FOR THE LASL WATER BOILER REACTOR. Gage, A. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1974. Contract W-7405-eng-36. 20p. Dep. NTIS $4.00.

An Sb-Be neutron source was designed for two purposes: to produce a larger neutron flux in the sphere of the Water Boiler Reactor during shut-down than that produced by the existing Ra-Be source, and to be a less hazardous source than the Ra-Be. The equilibrium strength of the Sb-Be source was calculated to be 6.2×10^6 neutrons/sec after 21 weeks of reactor operations. The sphere flux caused by the Sb-Be source, at equilibrium strength, was calculated to be 33,600 neutrons/cm^2-sec. Measurements of the sphere flux with indium foils and a fission counter showed that the flux caused by the Ra-Be source was 707 neutrons/cm^2-sec and that the equilibrium flux caused by the Sb-Be source was 13,000 neutrons/cm^2-sec, which was attained in about 20 weeks. (auth)

11908 (NBS-TN-813) NBS REACTOR: SUMMARY OF ACTIVITIES, JULY 1972-JUNE 1973. Carter, R. S. (National Bureau of Standards, Washington, D. C. (USA)). Feb 1974. 133p. GPO $1.55.

All those programs which depend on the NBS reactor are summarized. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production and radiation effects studies. (auth)

11909 (RCN-209) COUPLED FAST-THERMAL CRITICAL FACILITY STEK. Klippel, H. T.; Smit, J. (Stichting Reactor Centrum Nederland, Petten). Feb 1974. 54p. Dep. NTIS (US Sales Only) $5.75.

A detailed description of the STEK facility and its components is given. This zero power reactor has been operated at Petten from 1969 until 1973 for reactivity worth measurements of fission product samples. Five standard cores with different central neutron spectra are described. Build-up procedures, together with the main safety criteria, are outlined. To fulfill these criteria, multiplication factor measurements and neutron lifetime measurements have been performed. Results of these measurements are compared with predicted values. (auth)

11910 (SLA-73-959) SANDIA PULSED REACTOR III (SPR III): INITIAL TESTS AND OPERATIONS. Bonzon, L. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1974. Contract AT(29-1)-789. 33p. Dep. NTIS $4.75.

A summarization of initial tests and operations for the Sandia Pulsed Reactor III facility is given to provide an outline of (1) tests to be performed, (2) documentation required (3) test approval chains, and (4) test event sequences required for full operation by the end of 1974. (auth)

11911 (WARD-2171-44) FAST FLUX TEST FACILITY. Quarterly Progress Report for the Period Ending February 28, 1974. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1974. Contract AT(45-1)-2171- 31p. AT.

Research and development activities for the FFTF reactor are reported under the following headings: reactor systems; reactor components; plant systems and instrumentation and control components; plant mechanical components and heat transfer system; safety analysis and review; and materials application and component testing. (DCC)

11912 EXPERIMENTS FOR DETERMINING THE CRITICAL MASS OF A REACTOR CORE WITH MTR TYPE FUEL ELEMENTS. Krull, W.; Wrobel, H. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Geesthacht, Ger.). Atomkernenergie; 19: No. 3, 259(1972). (In German). (GKSS-72-E-16-(P.3)).

11913 EXPERIMENTS FOR THE USE OF PLATES AS SHIM RODS IN REACTORS WITH MTR-TYPE FUEL ELEMENTS. Krull, W. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Geesthacht, Ger.). Atomkernenergie; 18: No. 3, 198-202(1971). (In German). (GKSS-71-E-21).

Flux density and reactivity measurements of MTR elements with plate-type shim rods were performed. The influence on the horizontal thermal neutron flux density distribution and on the reactivity worth of the position of the plate-type shim rods in the special fuel elements was measured. The result is that the distance between the two plates should be as large as possible. The reactivity worth of plate-type shim rods made of Ag-In-Cd (80-15-5) is 85% higher than for the old oval-type shim rods. For Cd-plates the dependence on the reactivity worth on Cd thickness was measured. Ag-In-Cd plates have a 16.5% higher reactivity worth than pure Cd-plates. The results give a clear indication for the optimum design of plate-type shim rods for MTR-fuel elements. (GE)

11914 EXPERIMENTS AND CONSIDERATIONS FOR THE DESIGN AND THE POWER INCREASE OF THE THE FRG-2. Krull, W. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Geesthacht, Ger.). Atomkernenergie; 18: No. 4, 287-294(1971). (In German). (GKSS-71-E-22).

In material testing reactors a very high fast neutron flux density in a large number of irradiation positions is desired. To reach this for the FRG-2, many measurements were performed to determine the nuclear design (microstructive distribution of the thermal neutron flux density, dependence of the form factor on shim rods, capsules, position of capsules, reflector and complex core-configuration). Combined with a thermodynamical design and design considerations, an increase of the reactor power and of the fast neutron flux density by 50% is possible. It is shown that for a further development of the FRG-2 (^{235}U content of the fuel elements, total number and design of the shim rods, control rod program, compact core configuration, reflector, condition for the power scram) the fast neutron flux density can be increased by a factor of 1.65. The fast neutron flux density in the irradiation positions of the FRG-2 is then a max. 2.5 to 3.0×10^{14} cm^{-2} s^{-1} for a reactor power of 22 to 25 MW, which depends on the reactor lattice and the seasonal variation of coolant conditions. (GE)

11915 EXPERIMENTAL DETERMINATION OF THE ONSET OF NUCLEATE BOILING, THE CRITICAL HEAT FLUX DENSITY, AND THE VOLUMETRIC STEAM CONTENT IN AN ELECTRICALLY HEATED ROD BUNDLE AT LOW PRESSURE AND LARGE SUPERSATURATION. Varadi, G.; Staempfli, E. (Eidenoessische Inst. fuer Reaktorforschung, Wurenlingen, Switzerland). pp 538-556 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In German)

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

An experimental loop DINO was constructed to determine the conditions for the onset of nucleate boiling, burnout, and voids in the DIORIT reactor. The characteristics of DINO are summarized. The methods used for the measurement of the burnout and nucleate boiling are described. The measurement of the critical heat flux density as a function of the inlet supersaturation and mass flow density showed the normal linear relation between $\dot{q}_{BO}$ and inlet supersaturation. The measurement of the onset of nucleate boiling was in good agreement with calculated values. No results have been obtained on the measurements of voids. 4 references. (JSR)

Production and Materials Testing and Processing Reactors

Refer also to abstracts 11830, 11896, and 11912-11914.

11916 (DUN-8141) PT-N-331, REACTOR COOLANT TEMPERATURE MEASUREMENT WITH ZERO PRIMARY FLOW TO

ESTABLISH MAXIMUM FLOW SHUTOFF TIME. Cummings, K. N. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 19 Apr 1973. Contract AT(45-1)-1857. 20p. Dep. NTIS $4.00.

The need to have the capability to do maintenance work on the primary loop which requires flow stagnation provides strong incentive to determine the feasibility of long flow shutoff times following reactor shutdown. Previous production tests have collected data to support flow shutoff times on the order of 16 hours as soon as 54 days after shutdown. These previous tests were all performed with the graphite cooling system in service. The purpose of this test is to extend this previous testing in two ways: (1) Determine the feasibility of a usefully long flow shutoff time (on the order of 16 hours) as soon as three days after shutdown. (2) If time permits, determine the effect of the GCS on the flow shutoff time. (auth)

11917 (UNI-26) PRODUCTION TEST N-341, A PROCEDURE FOR ESTABLISHING LOW ONCE-THROUGH COOLANT FLOW DURING MAJOR REACTOR COMPONENT MAINTENANCE. Whitcomb, D. L. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 7 Jun 1973. Contract AT(45-1)-1857. 32p. Dep. NTIS $4.75.

A production test was designed to demonstrate a new method for cooling the reactor that will allow draining the primary loop so that valve inspection and repair can proceed. This method uses normal recirculation on the right side of the reactor and a very small, once through coolant from the ECS diesel pumps on the left side. Special flow indicating devices will be installed on the left side of the reactor to continually monitor coolant flow in process channels at the top of each left side riser. (auth)

11918 (UNI-26-B) PRODUCTION TEST N-341 SUP 1, A PROCEDURE FOR ESTABLISHING LOW ONCE-THROUGH COOLANT FLOW DURING MAJOR REACTOR COMPONENT MAINTENANCE. Whitcomb, D. L. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 15 Jun 1973. Contract AT(45-1)-1857. 39p. Dep. NTIS $5.00.

A production test was prepared to demonstrate the capability of establishing a once-through cooling mode for the reactor core that would allow draining the primary loop in the region of certain major primary loop components so that inspection and repair can be accomplished. This cooling method uses normal recirculation on the right side of the reactor core and a very small, once-through coolant flow from the Emergency Cooling Supply System on the left side. Special flow indicating devices will be installed on the left side of the reactor to continually monitor coolant flow in the process channels at the top of each left side riser. (auth)

11919 (UNI-83) DT-N-347, TEST OF PRESSURIZER BACK-UP AND COLD SPRAYS. Wellner, T. A. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 1 Nov 1973. Contract AT(45-1)-1857. 6p. Dep. NTIS $4.00.

The purpose of this test is to check the proper functioning of the pressurizer backup and cold sprays and to determine if the pressurizer pressure can be controlled during operation with the backup spray. The test involves turning off the normal spray valve and manually opening the backup spray control valve. If the backup spray is operating properly, the reactor is to be scrammed to check post-scram actions and plant response. If the backup spray does not work, the reactor will be shut down slowly. (auth)

11920 (UNI-83(Suppl. 1)) TEST OF PRESSURIZER BACK-UP AND COLD SPRAYS. Supplement to DT-N-347. Wellner, T. A. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 30 Jan 1974. Contract AT(45-1)-1857. 6p. Dep. NTIS $4.00.

The purpose of this test is to check the effectiveness of Design Change 3286, "Automatic Post Scram PC-215 and PC-216 pressurizer Pressure Controller Set Point Adjustment," and other improvements in the pressurizer spray system, in controlling the pressurizer pressure transient after a scram. The test authorizes reducing reactor power to 3000 Mwt and scramming the reactor to check post scram functions and plant response. The reactor will be scrammed in such a manner as to provide an additional check on the process tube flow monitoring system. The first tube to trip will be compared to those tubes which are most likely to trip. (auth)

Propulsion and Package Reactors

11921 (GKSS-74-E-3) DEVELOPMENT OF A DEVICE FOR THE MEASUREMENT OF FLOW RATES IN THE FDR. Froehner, K. R.; Mueller-Roos, J. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m. b. H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 19p. (In German). Dep. NTIS (US Sales Only) $4.00.

A flowmeter was developed, tested, and installed in the Otto Hahn PWR reactor for the purpose of measuring the flow rate through one of the three primary coolant nozzles. Early experimental results are reported. (auth)

11922 (GKSS-73-E-23) N. S. "OTTO HAHN": TEST REPORT NO. 21. Reconstruction of Reactor and Propulsion Equipment With Fuel Element Replacement Within the Time From September 4, 1972 to April 3, 1973 as well as Voyage No. 80 (Test Route) from April 5–14, 1973. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F.R. Germany)). 1973. 54p. (In German). Dep. NTIS (US Sales Only) $5.75.

Replacement of the fuel elements is described, as well as modifications of auxiliary plants, especially of the reactor auxiliary cycles, which were done in order to improve performance. Maintenance performed on the hull, main engine, and auxiliary boilers is described. Following incorporation of additional safety measures, the plant was put back into operation and a few test voyages were made in preparation for a trip to Monrovia on April 14, 1973. Data on the test voyages are included. (GE)

11923 (LA-5558) APPLICATION OF TECHNOLOGY FROM THE ROVER PROGRAM AND RELATED DEVELOPMENTS. Schreiber, R. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1974. Contract W-7405-eng-36. 11p. Dep. NTIS $4.00.

A review of the history of the Rover and UHTREX programs with particular emphasis on the development of technology which could be applied to present energy needs. The existing capabilities are then briefly described and two specific applications, process heat production and self-contained power and propulsion plants, are presented as examples of substantial promise for immediate work. (auth)

11924 PRODUCTION OF FISSIONING URANIUM PLASMA TO APPROXIMATE GAS-CORE REACTOR CONDITIONS. Lee, J. H. (Vanderbilt Univ., Nashville); McFarland, D. R.; Hohl, F.; Kim, K. H. Nucl. Technol.; 22: No. 3, 306-314(Jun 1974).

The intense burst of neutrons from the d-d reaction in a plasma-focus apparatus is exploited to produce a fissioning uranium plasma. The plasma-focus apparatus consists of a pair of coaxial electrodes and is energized by a 25 kJ capacitor bank. A 15-g rod of 93% enriched ^{235}U is placed in the end of the center electrode where an intense electron beam impinges during the plasma-focus formation. The resulting uranium plasma is heated to about 5 eV. Fission reactions are induced in the uranium plasma by neutrons from the d-d reaction which were moderated by the polyethylene walls. The fission yield is determined by evaluating the gamma peaks of ^{134}I, ^{138}Cs, and other fission products, and it is found that more than 10^6 fissions are induced in the uranium for each focus formation, with at least 1% of these occurring in the uranium plasma. This technique is most convenient and inexpensive for the study of a fissioning uranium plasma and can be extended to the production of other metallic plasmas in a high neutron flux. (auth)

11925 NUCLEAR PROPULSION OF MERCHANT SHIPS: FRENCH INTERESTS. Mabile, M. (CEN de Saclay, Gif-sur-Yvette, France). Rev. Fr. Energ.; 25: No. 257, 77-79(Oct 1973). (In French).

The current state of development of the French program for the nuclear propulsion of ships is rapidly reviewed. The market available for merchant ship propulsion equipment is discussed. (FR)

11926 NUCLEAR ENERGY ON THE MAASVLATE. Muysken, M. (Stichting Reactor Centrum Nederland, The Hague). Atoomenergie Haar Toepass.; 16: No. 1, 17-19(Jan 1974). (In Dutch).

Since 1971 the 12,000 ton nuclear ship Otto Hahn has been a regular visitor to Rotterdam and neighbouring ports on the Maasvlakte, with typical cargoes of African ores (inbound) and manufactured goods (outbound). The excellent operating record of this ship is adduced as evidence that the time has come for nuclear vessels to play a wider role in maritime transportation. Brief technical specifications of the Otto Hahn's nuclear installation are included, together with photographs. (NL)

11927 MERCHANT SHIPS WITH NUCLEAR ENERGY PROPULSION. Technical and Economical Prospects. Harde, R. (INTERATOM, Bensberg, Ger.); Schneider, E.; Ulken, D. Atomwirt., Atomtech.; 18: No. 7, 349-355(1973). (In German).

From reactor meeting; Karlsruhe, Ger. (10 Apr 1973).

Shipping and shipbuilding are in a phase of rapid expansion and show a trend to larger, faster and technically more sophisticated ships. Operating experience gained so far with nuclear

propulsion has been so satisfactory that in many countries investigations have started to determine the least size that would be competitive and the general technical and economic requirements. The present considerations stem from a German–Japanese study of a 80,000 SHP container ship. With the assumptions in question it appears that cost equality between nuclear and conventional propulsion shows a distinct cost advantage. In parallel with these investigations an appraisal was made of a 240,000 SHP nuclear ship. A firm tender for a demonstration ship of 80,000 SHP should be submitted towards the end of 1974. (GE)

11928 INVESTIGATIONS ON THE PRIMARY REACTOR SHIELDING OF THE NUCLEAR SHIP OTTO HAHN. II. Fiebig, R.; Frisius, F.; Hackbarth, H.; Richter, G. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Hamburg). Atomkernenergie; 18: No. 1, 71-78(1971). (In German). (GKSS-71-E-17).

For the purpose of a comparison with the results of shielding-calculations the radiation field was measured within the primary shield of the reactor of the nuclear ship "Otto Hahn". The results concerning the radiation intensities within the shield tank outside the pressure vessel are presented. The measured fluxes and dose rates are compared mainly with the results of the removal diffusion code Restrab. It was found that the program is overestimating the high energy part of the fast neutron spectrum but gives a reasonable accuracy for the total fast neutron flux density. For the calculation of the γ-dose rates the lateral distribution of the capture γ-radiation sources is taken into account by a reasonable approximation. A very good agreement with the measured values is obtained. (GE)

11929 INTERNATIONAL SYMPOSIUM ON NUCLEAR SHIPS. Lettnin, H.; Ulken, D. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Geesthacht, Ger.). Schiff Hafen; 24: No. 7, 3-7(1972). (In German). (GKSS-72-E-23).

From international symposium on nuclear ships; Madrid, Spain (17 Apr 1972).

One of the topics discussed at the symposium held in Madrid on the 17th and 18th of April, 1972 was the economic aspects of nuclear merchant ships. The nuclear ships MUTSU and OTTO HAHN were taken as examples problems were mentioned in connection with the design, operation and safety of nuclear-powered ships. (GE)

11930 TURBULENT HEAT TRANSFER TO HELIUM AND HYDROGEN IN HEATED TUBES WITH LARGE AXIALLY INCREASING TEMPERATURE DIFFERENCES. Pfriem, H. J. (Gesellschaft fuer Kernforschung, Karlsruhe, Ger.). pp 301-329 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Turbulent heat transfer measurements are given with helium in heated molybdenum tubes with wall temperatures up to 2300°K. Along with the measurements of Taylor, Weiland and Wolf/McCarthy with helium and hydrogen, equations are proposed for the case of large axially increasing temperature differences. 17 references. (auth)

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Refer also to abstracts 9252, 9275, 9495, 9498, 9500, 9502, 9566, 9572, 9576, 9807, 9986, 12025, and 12062.

11931 (ANCR-1149) EXPERIMENT DATA REPORT FOR SEMISCALE ISOTHERMAL TEST PROGRAM HOT-WALL TESTS. Feldman, E. M.; Pinson, P. A. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). May 1974. Contract AT(10-1)-1375. 225p. Dep. NTIS $14.25.

The hot-wall tests were performed in the isothermal portion of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project. The tests were conducted to determine the effect of stored wall heat on simulated ECC delivery. The experimental system consisted of a pressure vessel with simulated reactor internals; an operating loop with pump, steam generator, and pressurizer; a blowdown loop with a simulated pump, a simulated steam generator, and rupture assemblies; a pressure suppression system with header and pressure suppression tank; and a simulated ECC system with accumulators and injection pumps. Each of the five hot-wall tests was conducted immediately following completion of one of five isothermal blowdown tests and rapid draining of the lower plenum of the pressure vessel. Each hot-wall test was initiated by injection of simulated ECC into the cold legs of the operating loop and the blowdown loop. The hot-wall tests provided data for determining the time required for auxiliary cooling water (simulated ECC) to reach the vessel lower plenum and information relative to the effects of steam generation in the vessel downcomer region on the time required for simulated ECC delivery. In general, instrumentation used in the hot-wall tests functioned as intended and data loss was minimal. Of more than 700 measurements attempted during the five tests, more than 90% were accomplished. The data appear to be satisfactory for subsequent analysis. (auth)

11932 (ANCR-1150) EXPERIMENT DATA REPORT FOR SINGLE- AND TWO-PHASE STEADY STATE TESTS OF THE 1½-LOOP MOD-1 SEMISCALE SYSTEM PUMP. Olson, D. J. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). May 1974. Contract AT(10-1)-1375. 75p. Dep. NTIS $5.45.

Steady state tests using both single-phase and two-phase fluid as the working medium were conducted on a small centrifugal pump. The data obtained from the single- and two-phase tests together with the system description, test procedures, and error analysis are presented. (auth)

11933 (ANL–8069) FISSION-GAS BEHAVIOR DURING A MILD OVER-POWER TRANSIENT. Stahl, D.; Patrician, T. J. (Argonne National Lab., Ill. (USA)). Feb 1974. Contract W-31-109-eng-38. 24p. AT.

Fission-gas morphology and retention were determined by both replica electron fractography and laser sampling for two fast-reactor elements, one of which was subsequently transient-tested in TREAT. Both mixed-oxide fuel elements were irradiated in EBR-II at a peak power level of ~ 10 KW/ft to an average burnup of ~3.2 at. %. The H3 sodium-loop transient test was subjected to a short, flattop power input followed by a mild (50¢ to $1/sec) over-power ramp in TREAT. The TREAT transient caused additional fission gas to precipitate from solution or to coalesce from smaller unresolved bubbles. The degree of production and migration of these bubbles was dependent on the temperature and the temperature gradient. The density of ~650-Å intragranular bubbles increased by about an order of magnitude in the region of the equiaxed and unrestructured zone boundary. Laser sampling revealed that most of the fission gas retained in the fuel during steady-state operation was located in the unrestructured region and the cooler part of the equiaxed region. The additional release of ~8.7% of the gas during the transient was from these regions, principally through additional thermal-shock-induced cracks. (auth)

11934 (BN-TOP-2(Rev.2)) DESIGN FOR PIPE BREAK EFFECTS. (Bechtel Power Corp., San Francisco, Calif. (USA)). May 1974. 72p.

Analytical techniques to analyze fluid jet impingement loads and to establish design criteria for pipe restraints provided to prevent damage from pipe whip effects resulting from postulated pipe breaks in nuclear power plants are described. (auth)

11935 (CENPD-141) DDIFF CODE TOPICAL REPORT. (Combustion Engineering, Inc., Windsor, Conn. (USA)). 30 Apr 1974. 65p.

The time dependent pressure distribution within the building in which fluid is dispersed as a result of a reactor coolant system pipe rupture in the reactor cavity or steam generator compartment is investigated by using the DDIFF Code. Emphasis is placed on creating a detailed model for the regions nearest the break location. (DG)

11936 (CONF-740401-13) EFFECT OF PARTIAL BLOCKAGES IN SIMULATED LMFBR FUEL ASSEMBLIES. Fontana, M. H.; Gnadt, P. A.; Kress, T. S.; MacPherson, R. E.; Parsly, L. F.; Wantland, J. L. (Oak Ridge National Lab., Tenn. (USA)). 1974. Contract W-7405-eng-26. 29p. Dep. NTIS $4.50.

From conference on fast reactor safety; Beverly Hills, California, USA (2 Apr 1974).

Experimental data on the effects of partial blockages in simulated LMFBR rod bundles are reviewed and the results presented. Experiments performed in the ORNL Fuel Failure Mockup (FFM) with 13- and 24-channel inlet blockages in 19-rod sodium-cooled electrically heated rod bundles indicate that excessive temperatures do not occur as a result of the blockages. Similar experiments with 6-channel non-heat-generating blockages in the heated zone of the rod bundle indicate local temperature increases of ~170°F at 100% flow and at powers of ~10 kW/ft. A simple representation of flow recirculation in the wake of the blockage indicates that a small recirculating flow significantly reduces temperatures in the wake zone. Calculations of temperatures within heat-generating blockages indicate that in order to obtain temperatures above the cladding limit more than one subchannel must be blocked over a length in excess of 0.5 in. (auth)

11937 (CONF-740520-1) SOCIAL EFFECTS OF NUCLEAR POWER PLANTS. Peelle, E. (Oak Ridge National Lab., Tenn. (USA)). 1974. 9p. Dep. NTIS $4.00.

From fifth annual meeting of the Environmental Design Research Association; Milwaukee, Wisconsin, USA (30 May 1974).

Assessment of impacts involves dimensioning with fourteen descriptors, and analysis of impact recipient groups. Social impact alternatives are listed as are requirements for adequate social impact analysis. (auth)

11938 (CONF-740523-2) COMSYS: A COMPUTER CODE TO DETERMINE FISSION PRODUCT INVENTORIES AND RELATED QUANTITIES. Gileadi, A. E.; Musalem, A. (Puerto Rico Univ., Mayaguez). 1973. 15p. Dep. NTIS $4.00.

From seventh international congress of the French Society for Radioprotection; Versailles, France (28 May 1974).

The objectives, methods and scope of COMSYS are described. The computer code is designed to calculate fission product inventories and related quantities used for the evaluation of safety, heat balance, as well as certain biological and environmental effects associated with the operation of nuclear reactors. The basic option of COMSYS uses the build-up equations to determine number densities of individual fission products present in irradiated fuel. (10 references) (auth)

11939 (COO-2294-1) FLOW REGIMES IN A SIMULATED PWR DOWNCOMER ANNULUS. Wallis, G. B.; Block, J. A.; Crowley, C. J. (Dartmouth Coll., Hanover, N. H. (USA). Thayer School of Engineering). Jan 1974. Contract AT(11-1)-2294. 135p. Dep. NTIS $9.75.

The results are presented of an experimental and theoretical investigation of the possible flow regimes which could be present in the downcomer region of a pressurized water nuclear reactor during the emergency core coolant injection period of a postulated loss of coolant accident. Because a simplified flow geometry was studied, the results presented here have a general usefulness apart from the nuclear reactor modeling intended. The possible application of the results to flow behavior in a nuclear reactor is discussed. Water was injected transversely from a horizontal tube into the region formed by two parallel, transparent vertical plates. The flow patterns produced as the water impacted on these plates and fell under the influence of gravity were studied experimentally and theoretically. Several distinct flow patterns were observed; their size and shape are predictable by several analytical models. (auth)

11940 (EURFNR-1117) AEROSOL BEHAVIOR IN CLOSED CONTAINERS (PARDISEKO 2). Keller, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik). Aug 1973. 14p. (KFK-1758). Dep. NTIS $3.00.

Work performed under United States–Euratom Fast Reactor Exchange Program.

An aerosol model was developed and a corresponding computer program (PARDISEKO II) written which permit prediction of the time behavior of aerosols in closed containers (e.g., reactor containments). The model includes the following elementary aerosol-mechanical processes: coagulation due to Brownian motion, diffusion to the walls of the container, sedimentation, thermophoresis at the containment walls, a continuous, time independent, source. The model achieves satisfactory agreement with experiments. (7 references) (auth)

11941 (EURFNR-1136) CONTRIBUTION TO THE MODELING OF SODIUM BOILING UNDER ACCIDENT CONDITIONS IN FAST BREEDER REACTORS. Wirtz, P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). Oct 1973. 120p. Dep. NTIS $9.25.

Work performed under United States–Euratom Fast Reactor Exchange Program.

A theoretical model is developed which describes integral boiling of the coolant in sodium cooled fast reactors under characteristic failure conditions. Based on results achieved in non-steady state boiling experiments under conditions similar to those in a reactor and on theoretical considerations, the model calculates the ejection of sodium from a fuel element and the subsequent boiling behavior. The flow pattern is characterized by the formation of one or a few individual bubbles in the early stage of boiling and is, therefore, comparable to a slug type flow. The assumption of uniform pressure within a bubble is dropped. Thus it is possible to describe an annular type flow which is generated if the boiling zone reaches a larger axial expansion and contacts areas of greatly differing temperatures. Taking into account the pressure drop within a bubble has a decisive influence upon the boiling event in a fuel element. For analyses of fuel pin cooling after boiling inception the condition of the liquid film remaining on the fuel pins after the ejection of sodium is calculated as function of time and position. It is shown that the influence of the vapor flow on the film behavior greatly reduces the liquid film dryout time. A comparison between model calculations and experiments shows good agreement with respect to the ejection of sodium and the oscillatory behavior of the coolant flow in the later stages of boiling. The model gives a good qualitative description of dryout. There is a better agreement between calculation and experiment both for the overall boiling behavior and the dryout time assuming a stagnant film. The more or less random occurrence of dryout can be explained by the model, but cannot be accurately predetermined in a deterministic way. The computer program BLOW 3 based on the theoretical model can be integrated into a code system for the overall accident analysis of sodium cooled fast reactors. The good simulation of the thermohydraulic behavior of a fuel element allows analyses of characteristic accidents and their detectability. Results are presented from boiling calculations for characteristic SNR coolant channels. (auth)

11942 (FRNC-TH-475) URANIUM DIOXIDE–SODIUM INTERACTIONS. Development of a Theoretical Model. Fitting of This Model to the Experimental Results. Syrmalenios, P. (Grenoble-1 Univ., 38 (France)). 1973. 186p. (In French). Dep. NTIS (US Sales Only) $12.50.

Thesis.

Molten fuel-sodium interaction mechanisms were studied in order to evaluate the consequences of a nuclear reactor accident. In the first approximation made, materials other than molten uranium dioxide and sodium (e.g. solid uranium dioxide, plutonium dioxide, stainless steel, and fission products) were neglected. A weighted model, which describes the thermal interaction dynamics of molten uranium dioxide and sodium, was used. The CORFOU (Contact Refrigerant Oxyde Uranium) code developed from the model enabled the experimental results to be interpreted after the appropriate fitting of the unknown parameters of the model using a simple boiling sodium experiment. The CORFOU code does not provide an accurate description of the fuel-coolant interaction in the preliminary phase, where the coolant is in the liquid state (duration of a few μs), as the propagation of pressure waves is neglected. On the other hand, the appearance of fragmented UO_2 (in the form of grains) in the code permitted the JEF experiment to be interpreted, the fragmentation in this experiment occurring at each recondensation of the vapor pocket. Shock tube aluminium/water experiments can also be interpreted with the model proposed. In the second phase (duration of the order of milliseconds) the vaporization rate was then taken into consideration, i.e. the existence of liquid at an average temperature other than the saturation vapor temperature is admitted (thermodynamic disequilibrium hypothesis). A variation in the mass of coolant interacting with hot substances can be calculated during the reaction. Heat diffusion into the environment can thus be taken into account. Transferrence by the cold liquid produced as a result of expansion occurring in the interaction zone can be described. (FR)

11943 (GA-A-12045(Add. 1)) ADDENDUM 1: QUALIFICATION OF FORT ST. VRAIN SAFE SHUTDOWN EQUIPMENT FOR STEAM ENVIRONMENT RESULTING FROM PIPE RUPTURES. Burwell, E. J. (General Atomic Co., San Diego, Calif. (USA)). 15 Mar 1974. Contract AT(04-3)-633. 30p. Dep. NTIS $4.00.

High-temperature steam qualification tests were performed on the System 21 seal and brake solenoid valve and on the System 91 Manatrol directional control solenoid valve. Tests were conducted in small, externally heated, multipurpose autoclave. Results indicated that the valves can operate without failure in the environment simulating the temperature profile previously achieved for the Fort St. VRAIN steam accident condition and would continue to operate during completion of the safe shutdown procedure. (DG)

11944 (GA-A-12462) SORS: COMPUTER PROGRAMS FOR ANALYZING FISSION PRODUCT RELEASE FROM HTGR CORES DURING TRANSIENT TEMPERATURE EXCURSIONS. Schwartz, M. H.; Sedgley, D. B.; Mendonca, M. M. (General Atomic Co., San Diego, Calif. (USA)). 15 Apr 1974. 80p. (GA-LTR-10).

The computer program SORSD was developed to calculate the release of volatile fission product activity from an HTGR core during transient temperature excursions, such as a hypothetical loss of forced circulation. This core release is the source activity on which subsequent environment dose calculations may be based. SORSG, an extension of SORSD, was developed to include the significant effects of sorption within the core of all the non-gaseous fission product species. SORSG has also been further modified to calculate the behavior of non-fission product core materials such as the actinide elements, control poison, and the core graphite itself. Both programs utilize a segmented cylindrical core spatial model with associated values of material quantities and temperature conditions. The fission product transport and de-

cay chain behavior is described by a set of differential equations. This set of equations describes the entire core inventory of fission products by means of calculated parameters based on the detailed spatial core conditions. The program determines the time-dependent amounts of fission product nuclides that escape from the core in the gas phase. (auth)

11945 (GA-A-12883) DESIGN AND SEISMIC ANALYSIS OF NUCLEAR PIPING AND VALVES AT FORT ST. VRAIN. Rath, U. K.; Garvey, L. J.; Wesley, D. A. (General Atomic Co., San Diego, Calif. (USA)). 25 Jan 1974. Contract AT(04-3)-633. 24p. (CONF-740606-16). Dep. NTIS $4.25.

From pressure vessels and piping-materials-nuclear conference; Miami Beach, Florida, USA (24 Jun 1974).

Three classes of nuclear piping were developed and designed in accordance with ANSI B31.7, "Nuclear Power Piping." Piping design tables were developed for each specific category depending on requirements for the various fluid systems in the HTGR plant. Allowable stress values of ANSI B31.1.0, "Power Piping," were used. All nuclear piping was constructed in accordance with the ANSI B31.7. All nuclear valves were designed in accordance with ANSI B31.7 and conformed to ANSI B16.5 or MSS-SP-66. Selected leak-tight valves using a special packing or a bellows seal were used in systems with helium. All Class 1 and 2 piping systems and valves were designed and analyzed in conformance with the provisions of ANSI B31.1.0. The effect of the operating basis and safe shutdown earthquakes was considered in the design of piping, piping supports, and restraints for systems included in the Class I list. The stresses resulting from the earthquake effects were included with weight, thermal, pressure, and other mechanical loads for comparison with allowable stresses. Detailed dynamic analysis was performed on line sizes 10 inch (254 mm) NPS and larger. Seismic design curves based on a simplified dynamic analysis of typical pipe spans were used for lines 8 inch (203.2 mm) NPS and smaller. (auth)

11946 (GKSS-74-E-8) PROGRESS REPORT ON SAFETY EXPERIMENTS AT THE NUCLEAR POWER PLANT MARVIKEN, SWEDEN. Franke, W. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m. b. H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 22p. (In German). Dep. NTIS (US Sales Only) $4.25.

Experiments on containment following pipe rupture in a primary coolant circuit and iodine migration studies are described. The experimental facilities and programs are described and preliminary experimental results are given. (GE)

11947 (HEDL-SA-645) DEFORMATION AND FAILURE OF FAST REACTOR CLADDING DURING SIMULATED LOSS-OF-FLOW TYPE TRANSIENTS. Hunter, C. W.; Fish, R. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). [nd]. Contract AT(45-1)-2170. 16p. (CONF-740443-1). Dep. NTIS $4.00.

From meeting on fast reactor safety; Los Angeles, California, USA (2 Apr 1974).

The deformation and failure behavior of 20% cold worked Type 316 stainless steel fuel cladding was experimentally determined under thermal transients and internal gas pressures, which simulated hypothetical loss-of-flow accident conditions. Both unirradiated and EBR-II irradiated tubular cladding specimens ($7.4\text{-}9.0 \times 10^{21}$ n/cm^2, $E_n > 0.1$ MeV) were subjected to heating rates of 10 and 200°F/sec, with hoop stress loadings of 1300 to 6480 psi. These test conditions produced cladding failure at temperatures from 2000 to 2400°F. In unirradiated cladding the failure temperature increased and the strains at failure decreased with decreasing hoop stress levels. Similar trends were observed in the EBR-II irradiated cladding, except that the failure ductilities were greatly reduced and the failure temperatures were moderately reduced. The results demonstrate that the ductility of cladding will not be so great as to permit excessive cladding deformations which could interfere with coolant flow. Beginning-of-life pin gas pressures are insufficient to produce failures except at very high temperatures (2400°F), where the failure strains are only about 0.5% in unirradiated cladding. For irradiated cladding, even after only low levels of irradiation, the ductility is sufficiently reduced for all conditions that coolant flow could not be impaired. (auth)

11948 (IAEA-154, pp 257-265) GCFR SAFETY. Chermanne, J. (Belgonucleaire, Brussels). 1973.

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The safety aspects of GCFR technique are closely related to those of present other gas-cooled reactors such as AGR and HTR. The higher coolant pressure needed brings more severe conditions regarding depressurization. Some part of the LMFBR safety can also be used. (auth)

11949 (IAEA-154, pp 289-306) SAFETY QUESTIONS FOR A PLANT WITH A DISSOCIATING GAS AS A COOLANT. Sharovarov, G. A. (Inst. of Nuclear Energy, Minsk). 1973. (In Russian).

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

An analysis is made of the behavior of the reactor with dissociating gas as coolant in emergency conditions. It is shown that the characteristics of the technological plan and the thermodynamic cycle makes it possible to continue uninterrupted circulation and the original heat removal during cooling after triggering of the shield in emergency situations. The physical-chemical properties of the dissociating coolant makes it possible to use the coolant in the liquid phase. In order to prevent deformation and fracture of the construction elements of the reactor means of limiting the discharge of the coolant from the high pressure zone should be provided. The density effect of the coolant has a slight effect on the emergency process. Special emergency systems for cooling reactors are, however, advisable. (tr-auth)

11950 (IAEA-154, pp 307-324) SAFETY OF GAS-COOLED FAST REACTORS. Kovalevich, O. M. (Inst. of Atomic Energy, Moscow). 1973. (In Russian).

From meeting on gas-cooled fast reactors; Minsk, USSR (24 Jul 1972).

The behavior of the reactor during three emergency situations — shut-down or failure of the gas blowers, rupture of the primary loop, and melting of the active zone with energy release in the form of explosion — was considered from the viewpoint of the safety precautions to be taken. The concept or philosophy of safety was first discussed. (JSR)

11951 (INIS-mf-1331) FISSION PRODUCT NOBLE GASES IN NUCLEAR POWER STATION OPERATION. Abraham, P.; Soman, S. D. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). [nd]. 17p. INIS.

From noble gas symposium; Las Vegas, Nevada (USA) (24 Sep 1973).

Experience with noble gas radioactivity during the operation of the 400 MW(e) twin BWR station at Tarapur, India, is presented. The design measures to minimize, control and monitor the discharge of noble gases from the station into the environment are described. The limits prescribed for the gaseous effluents from the station are given along with the assumptions used to derive them. Actual environmental releases during the four years of station operation are tabulated. Gamma spectrum and decay curve of typical off-gas samples are presented and analyzed. The effect of fuel defects on the isotopic composition of the gaseous releases during operation and the problems encountered in operating the reactors with defective fuel are discussed. (auth)

11952 (JAPFNR-150) MEASUREMENT OF FLOW AROUND A LOCAL BLOCKAGE IN A FUEL ASSEMBLY. Toko, Y.; Kondo, S. (Tokyo Univ. (Japan). Faculty of Engineering). Jan 1974. 90p. (PNC-N-251-73-4). Dep. NTIS (US Sales Only) $7.50.

For Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan).

In the safety analysis of LMFBR accidents, local blocking of channels is regarded as an important problem. An understanding of flow characteristics near blocked parts is important for the analysis of accidents. Characteristics of the local flow were investigated as a part of research on the establishment of analytical methods for propagation behavior of local fuel failure. The kind and scale of accidents which may occur as a result of blockage in fuel assemblies were examined. (auth)

11953 (MRR-125) RELIABILITY OF NUCLEAR PLANT. Bastl, W. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Jul 1973. 51p. (CONF-730714-5). Dep. NTIS (US Sales Only) $5.75.

From generic techniques in systems reliability assessment conference; Liverpool, UK (16 Jul 1973).

The implementation of the probabilistic approach for designing and assessing nuclear power stations raises the problem of getting adequate failure rates. The fundamental considerations for gathering field data are given, on the basis of a practical experiment performed with a thermal power plant. The reliability of equipment is discussed in light of the specific requirements for reactor safety systems, i.e. the layout against dangerous faults. Some examples of practical and theoretical investigations on vital equipment are given. Finally a fault tree analysis is demonstrated, with the aim to compare two different configurations of the power supply for safety injection pumps of an emergency system. The relevant decision-making parts of the investigation are shown in detail. Also the various results of the simulation program with respect to the reliability and the availability of the system are given. (auth)

11954 (MRR-133) SIMULATION STUDIES ON THE COMPUTERIZED TESTING OF SAFETY DEVICES. Part 1. Analog

Model for the Simulation of Faults in the Emergency Cooling System of a Boiling Water Reactor. Hawickhorst, W. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Dec 1973. 67p. (In German). Dep. NTIS (US Sales Only) $6.50.

The development and testing of computerized checking procedures, which are applicable to the engineered safety systems of nuclear power plants, require simulation experiments. An analog model of a loop-configuration, typical for an important group of engineered safety systems of light water reactors, is described. The analog model is drafted to meet the special requirements of fault generation and will be used in a corresponding hybrid simulation. (auth)

11955 (NP-20018) ANNUAL REPORT, 1972. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Jul 1973. 93p. (In German). Dep. NTIS (US Sales Only) $7.75.

Reactor safety research in the following areas is summarized: reactor physics and reactor dynamics; emergency core cooling; containment problems; systems analysis and reliability techniques; analysis of stochastic processes; reactor control; and use of computer systems. (JWR)

11956 (ORNL-TM-4303) DISTRIBUTION AND RELEASE OF TRITIUM IN HIGH-TEMPERATURE GAS-COOLED REACTORS AS A FUNCTION OF DESIGN, OPERATIONAL, AND MATERIAL PARAMETERS. Compere, E. L.; Freid, S. H.; Nestor, C. W. (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 95p. Dep. NTIS $5.45.

Tritium will be produced in high-temperature gas-cooled reactors not only by fission, but also to a significant extent by reactions of neutrons with boron in burnable poison and control rods, with trace lithium impurity, and with ^3He occurring naturally in the helium coolant flowing through the core. A portion of the tritium that is formed in solids or fuel may be released to the coolant. This tritium mingles with the hydrogen in the coolant and will, in part, chemisorb on graphite. In addition, it may leak with the coolant from the reactor vessel, be removed in the helium purification system, or permeate system walls into the steam generator, where as a result of removal (blowdown) or losses it is subject to release to the environment. The differential equations describing the above behavior are developed. Assumption of steady conditions, including hydrogen concentration, for a period makes it possible to express the distribution as well as the production in the form of coupled sets of linear first-order ordinary differential equations. A generalized analytical solution of these is presented. The above tritium generation and distribution model has been incorporated in a computer code, TRITGO. An illustrative calculation using parameters taken from the PSAR description of the Fort St. Vrain Reactor has been made. This indicates that most of the tritium emerging from the primary coolant will have been generated by the $^3He(n,p)T$ reaction. A significant fraction enters the steam generator. The tritium in the steam generator blowdown, after proper dilution, may be considered for release to the environment. The effects of varying a number of system parameters are considered. (auth)

11957 (PB-227824) ESTIMATE OF THE RISK OF ACCIDENTAL RADIOLOGICAL EXPOSURE FROM A BOILING WATER REACTOR. Paper No. 72-12. Schleicher, R.; Cady, K. B. (Cornell Univ., Ithaca, N. Y. (USA)). Apr 1972. 34p.

A general model is presented for evaluating the accidental risk of radiological exposure to the population from a boiling water reactor, where accidental risk is defined as the sum of the products of the probabilities and the consequences for all conceivable accidents. The accident spectrum considered ranges from high probability events such as static fuel failures and fuel handling accidents to low probability events such as loss of coolant and loss of containment accidents. The probabilities are evaluated by taking the product of the expected initiating event frequencies and the probability that the safety system will or will not respond appropriately. The initiating event frequencies are estimated from available data, and the safety system reliabilities are determined by fault tree techniques. The consequences are expressed as whole-body and thyroid doses to the specified population about the reactor site. They are calculated by determining the accidental releases of all important isotopes, and transforming the releases into population dose by multiplying by the atmospheric transport and dose conversion factors. The calculation takes into account a distribution of meteorological stabilities and wind speeds. The resulting value of the expected accidental risk is 1.3 man-rem/yr whole-body dose and 18 man-rem/yr thyroid dose to a typical population of five million people within a fifty mile radius of a 1500 MWt boiling water reactor. For purposes of comparison, the risk from routine releases of radioactivity, based on the limiting criterion of 500 mr/yr to an individual at the site boundary, is 58,000 man-rem/yr whole-body and 11 man-rem/yr thyroid dose. The reduction of the site boundary criterion to 10 mr/yr roughly reduces the routine releases by a factor of fifty, resulting in population doses of 1,200 man-rem/yr whole-body and 0.22 man-rem/yr thyroid dose to the population. The major contributions to the accidental risk are from the high frequency static fuel failure and fuel handling accidents. The risk from high consequence accidents such as major loss of coolant and loss of containment accidents is small by comparison because of the associated low probabilities. (auth)

11958 (WASH-1283(Rev.1)) GUIDANCE ON QUALITY ASSURANCE REQUIREMENTS DURING DESIGN AND PROCUREMENT PHASE OF NUCLEAR POWER PLANTS, REVISION 1. (USAEC, Washington, D. C.). 24 May 1974. 179p. Dep. NTIS $7.60.

Guidance is presented in the form of standards developed under the American National Standards Institute Subcommittee N45-2, Nuclear Quality Assurance Standards. Information is updated from the June 7, 1973 edition by including applicable AEC Regulations, regulatory guides, latest copies of draft N45-2 standards, and a revision of the paper "The Status and Application of ANSI N45-2 Standards." Supplementary guidance is also provided. (FS)

11959 (WASH-1314) SUMMARY OF ABNORMAL OCCURRENCES REPORTED TO THE ATOMIC ENERGY COMMISSION DURING 1973. Thompson, D.; Boyle, E. L.; Grosman, L. H. (USAEC Office of Operations Evaluation, Washington, D. C.). May 1974. 75p. Dep. NTIS $6.75.

Reports of 861 abnormal occurrences that took place at nuclear power plants during 1973 and that were reported to the AEC are categorized with respect to cause, significance, method of discovery, status of the reactor at the time of discovery and component and system involved. Categorization was based on information extracted from incoming licensee reports. The information was stored, sorted and retrieved by computer. Results indicate that over half of the reported events had no direct or potential safety significance; 12 events involved release of radioactivity with none of these 12 resulting in release of amounts in excess of permitted values; slightly over half of the events were detected by tests or inspections; component failures were the proximate causes of about half of the events; about one quarter of the events took place during steady-state power operation; valves and valve operators were involved in more events than any other three components combined; and the primary coolant system was involved in more events than any other system. (FS)

11960 (WASH-1535-DR(Vol.1)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume I. Summary and Background. Environmental Statement. (USAEC, Washington, D. C.). Mar 1974. 228p. Dep. NTIS $14.50.

For each of the elements of the LMFBR fuel cycle, the environmental impacts resulting from the construction, operation and postulated accidents associated with a single representative plant, viz., individual fuel fabrication, fuel reprocessing and reactor plants, along with the attendant radioactive waste management and transportation activities are used as a basis for subsequent determination of the overall cumulative effects and unavoidable adverse environmental impacts of the LMFBR fuel cycle. The broad economic, social and other secondary impacts resulting from implementation of the LMFBR Program are defined. Alternatives for mitigating adverse environmental impacts of the LMFBR fuel cycle, based either upon currently feasible methods or potential future developments are presented. Alternative options to the implementation of the LMFBR Program and their environmental impacts are evaluated. Potential relationships between short-term environmental benefits and long-term environmental losses brought on by implementing the LMFBR Program are discussed. The irreversible and irretrievable commitments of resources resulting from implementation of the LMFBR Program and a cost-benefit analysis of implementation of the LMFBR Program are presented. (FS)

11961 (WASH-1535-DR(Vol.1)(Pt.2)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume II. Environmental Impact of the LMFBR. Environmental Statement. (USAEC, Washington, D. C.). Mar 1974. 532p. Dep. NTIS $29.75.

Information is presented concerning the transportation of radioactive materials, radioactive waste management and plutonium toxicity. Appendices are included which describe the probability of transport accidents, calculation for determining population exposure from transport, risks in transport from nonradiological causes, types of packages, exposure assumptions and dose-conversion factors used in estimating radiation doses, Hanford leak incident of 6/8/73, plutonium toxicity, biological effects of cooling systems, assumptions and models used to assess environmental effects, effects on biota, deposition velocity of HF, assumptions and procedures for calculating fluorine accumulation in forage,

regulatory standards and requirements, and detailed assumptions and calculations for transportation accidents. (FS)

11962 (WASH-1535-DR(Vol.2)(Pt.1)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume II. Environmental Impact of the LMFBR. Environmental Statement. (USAEC, Washington, D. C.). Mar 1974. 524p. Dep. NTIS $29.25.

The LMFBR fuel cycle is described including the power plant, fuel-fabrication plant, and fuel reprocessing plant. Environmental monitoring and environmental effects of construction, operation and postulated accidents are discussed. (FS)

11963 (WASH-1535-DR(Vol.3)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume III. Implication of LMFBR Program Implementation. Environmental Statement. (USAEC, Washington, D. C.). Mar 1974. 526p. Dep. NTIS $29.50.

The indirect effects on our society of the introduction of the LMFBR are found to be very similar to, or natural extensions of, those for present day reactor systems. In the industrial sector it is the utilities which will be most directly affected. The very large capital requirements that are anticipated will stretch and probably change utility financing methods. The LMFBR will also require increased technical sophistication on the part of the utility industry, with a net beneficial social impact. Increased requirements of technical and manufacturing sophistication will extend to other industries involved in supplying equipment for the entire nuclear energy system. Otherwise the effect on industries not directly involved in the fuel cycle is expected to be small. Although the national economic impact of the anticipated LMFBR construction program is significant (possibly amounting to more than 10% of credit market funding), the impact on the local or regional scale can be even greater. The possibility of placing large numbers of LMFBR's in power parks emphasizes the need for regional energy planning, an activity currently devoid of both institutions and analytical methods. It is difficult to quantify the benefits of energy to society, the close relationship between national energy use per capita and economic growth or personal energy use and standard of living are established. As particular energy resources are consumed, new technologies must be developed to assure that energy is available to society to fulfill its needs at acceptable total cost. The LMFBR represents a logical technological evolution corresponding to changing conditions that will assure the continued provision to society of the benefits of energy at acceptable economic and environmental cost. (FS)

11964 (WASH-1535-DR(Vol.4)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume IV. Alternative Technology Options. Environmental Statement. (USAEC, Washington, D. C.). Mar 1974. 751p. Dep. NTIS $40.75.

Available alternate energy options including other means of exploiting nuclear energy, non-nuclear energy sources, more efficient means of converting energy resources to useful forms, and more conservative means of using the available energy are evaluated. Light water reactors, high temperature gas-cooled reactors, light water breeder reactors, gas cooled fast breeder reactors, molten salt breeder reactors, and controlled thermonuclear reactors, fossil fuels for central station electrical generation, natural gas and oil, domestic tar shales, hydroelectric power systems, geothermal energy, solar energy, wind power, ocean thermal gradients, tidal energy, hydrogen, and synthetic fuels are described. Improved energy conversion and storage devices including steam turbine systems, internal combustion engines, gas turbines, binary cycles, fuel cells, batteries, thermoelectric converters, thermionic converters, magnetohydrodynamics are evaluated. The conservation of energy including power plant energy conversion efficiencies, gross vs net generation of electricity, transmission and distribution, and the utilization of energy are discussed. (FS)

11965 (WCAP-8110(Supp. 5)) TEST PLANS AND RESULTS FOR THE ICE CONDENSER SYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). 24 May 1974. 23p.

The dynamic test of the lower inlet door shock absorber for the Westinghouse ice condenser system is described. (JWR)

11966 (WCAP-8110(Supp. 6)) TEST PLANS AND RESULTS FOR THE ICE CONDENSER SYSTEM. Ice Condenser Full-Scale Section Test at the Waltz Mill Facility. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). May 1974. 240p.

Tests to determine the transient heat transfer and fluid flow performance of the ice condenser design and to confirm that conclusions drawn from previous tests have not been significantly changed by equipment redesign are described. (JWR)

11967 (WCAP-8110(Supp. 7)) TEST PLANS AND RESULTS FOR THE ICE CONDENSER SYSTEM. Answers to AEC Questions on Report WCAP-8282. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). May 1974. 30p.

Answers to questions on current tests of the PWR ice condenser are provided. The tests were conducted to determine the transient heat transfer and fluid flow performance of the ice condenser and to confirm conclusions derived from previous tests. (FS)

11968 (WCAP-8110(Supp.8)) TEST PLANS AND RESULTS FOR THE ICE CONDENSER SYSTEM. Topical Report on the Stress and Structural Analyses and Testing of Ice Baskets. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). May 1974. 136p.

Description and documentation of the analyses and test performed on the modified ice baskets (mesh openings changed from ½ in. × ½ in. to 1 in. × 1 in.) used in the Ace Condenser System are provided. Also, further tests to be performed on the lead production units are listed. The ice baskets were analyzed and tested for structural loads which envelope the respective design conditions for the D. C. Cook, Sequoyah, McGuire, and Catawba Nuclear Power Plants. (DG)

11969 (WCAP-8110(Supp. 9)) ICE FALLOUT FROM SEISMIC TESTING OF FUSED ICE BASKET. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). 13 May 1974. 6p.

The loss of ice from containers used in the Westinghouse Ice Condenser System under seismic conditions was investigated. The containers (1″ × 1″ perforations, 64% open area), filled with fused borated flakice, were subjected to vibrations designed to simulate plant time history seismic disturbances. The ice loss for each history cycle was less than 1%. The ice containers showed no structural damage after being subjected to additional sinesweep and sine beat tests. (DG)

11970 (WCAP-8271) PRESSURIZED WATER AND STEAM JET EFFECTS ON CONCRETE. Stevenson, J. D.; Paddleford, D. F.; Mitchell, P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). PWR Systems Div.). May 1974. 36p.

Ten experimental tests were run to determine the effect of pressurized water and steam jets impinging on reinforced concrete beams. Three jet diameters (1, 2 and 4 inches) were investigated, at 1 and 4-foot ranges. Evaluation of test results showed erosion of concrete by steam or subcooled PWR water jet impingement definitely does not impose a design consideration. A concrete beam subjected to a one-inch PWR system jet in excess of three minutes showed no deleterious erosion effect. As in the case of the two and four-inch jets, the effect was similar to that of light sand blasting, showing an erosion of surface cement paste less than 30 mils in depth. No displacement of coarse aggregate was observed. All observations indicate that short-term erosion as a result of primary coolant or steam line break need not be a design consideration. (auth)

11971 (WCAP-8288) SAFETY ANALYSIS OF THE 17 × 17 FUEL ASSEMBLY FOR COMBINED SEISMIC AND LOSS-OF-COOLANT ACCIDENT. Gesinski, L.; Chiang, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Dec 1973. 59p.

Analysis of the 17 × 17 fuel assembly component stresses and impact forces due to a simultaneous LOCA and seismic wave (up to 0.4 g) indicated that the design is structurally acceptable based on the established allowable design limits. (FS)

11972 (WCAP-8312(Rev.1)) WESTINGHOUSE MASS AND ENERGY RELEASE DATA FOR CONTAINMENT DESIGN. Shepard, R. M.; Massie, H. W.; Mark, R. H.; Docherty, P. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). PWR Systems Div.). Mar 1974. 173p.

Methods of determining maximum containment pressures following a loss of coolant accident (primary pipe rupture assumption) are presented. Long term and short term mass and energy release transients are treated separately. Results are presented in tables. (DG)

11973 (WCAP-8323) EFFECT OF A BOWED ROD ON DNB. Hill, K. W.; Motley, F. E.; Cadek, F. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). [nd]. 28p.

Flow tests using an electrically heated rod bundle were conducted. The 14 foot length rod bundle consisted of sixteen 0.422 inch diameter rods with Westinghouse mixing vane grids on 26 inch spacing, with one rod bowed into contact with two adjacent rods. The bow was at the midspan between two mixing vane grids in the region where DNB is predicted to occur (i.e., near the point of minimum DNBR). Test results indicate that rod bowing can have a deleterious effect on DNB and that this bowing effect is dependent only on system pressure and rod average heat flux (i.e., power). However, this adverse bowing effect applies only above a certain heat flux threshold. (auth)

11974 (WCAP-8346) EVALUATION OF FUEL ROD BOWING. Sheppard, K. D.; Cerni, S.; Reavis, J. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). May 1974. 73p.

The bowing of fuel rods in Westinghouse designed PWR cores is examined for the purpose of characterizing and quantifying the phenomenon, and to confirm that current design safety margins adequately accommodate the bowing effects. (DG)

11975 NUCLEAR POWER PLANTS. Dozinel, P. (Societe de Traction et d'Electricite, Brussels). Bull., Soc. Roy. Belge Elec.; 89: No. 3, 207-217(1973). (In French).

After a review of the conditions under which nuclear energy was born and a rapid survey of the problem of energy, the problem of the hazards of industrial enterprises is examined. The methods used to decrease the hazard of nuclear power plants are discussed: redundancy, separation, fail-safe operation, quality control, and quality assurance. The implication of these basic rules on the equipment and particularly the electrical equipment is considered. (tr-auth)

11976 CONSTRUCTORS POINT OF VIEW ON NUCLEAR SAFETY. Bondoux, R.; Millot, J. P. (Societe Franco-Americaine de Constructions Atomiques, Courbevoie, France). Ann. Mines; No. 1, 27-40(Jan 1974). (In French).

It is shown (using a pressurized ordinary water reactor as an example) how different safety regulations can assist the constructors of nuclear plants at all stages in their development from their initial conception up to their start-up. The following points are reviewed: the three barriers interposed between the fission products and the environment; study of the reactor core; the development of special systems (control, protection, servo); research and development in the field of pressurized vessels; start-up tests; the quality of the research and development conducted, this factor being the best safety guarantee for the plants. (FR)

11977 CALCULATION OF THE TRANSILNT TEMPERATURE PATTERN IN A VESSEL OF A PWR-TYPE REACTOR IN CASE OF EMERGENCY COOLING. Teichel, H. (Technische Univ., Brunswick). Brennst.-Waerme-Kraft; 25: No. 5, 199-203(May 1973). (In German).

The transient temperature distribution in the wall of a pressure vessel of a nuclear reactor is determined by means of a modified BINDER-SCHMIDT procedure, with heat transfer processes from the literature being taken into account as boundary conditions. The results of calculations show that maximum temperature differences and thus a peak in stress values are to be expected after a period of about 15 min. (GE)

11978 SAFETY PROBLEMS SURROUNDING NUCLEAR POWER GENERATION. Uchida, H. (Tokyo Univ.). Genshiryoku Kogyo; 19: No. 9, 9-13(Sep 1973). (In Japanese).

With the progressive increase in the capacity of nuclear power plants, and in the information on the danger and safety of reactors, more realistic and quantitative safety consideration becomes important in connection with power plant siting. In normal operation, the radiation control in waste disposal is fairly well observed. In conceivable accidents such as loss of coolant, the insurance of no hazard to populace is absolutely required, the objective in nuclear power safety. The design on the basis of the conceivable accidents in this connection is described. There may be accidents beyond DBA. In the evaluation of safety by PQ (probability and hazard magnitude, respectively), the probability becomes highly significant. Concerning the probabilistic assessment of reactor accidents, the studies made in radiation exposure are briefed. (JA)

11979 CONTROL EXERCISED BY ELECTRICITY DE FRANCE DURING THE CONSTRUCTION OF NUCLEAR PLANTS. Vaujours, J. A.; Bonnard, Y. (Electricite de France, Courbevoie). Ann. Mines; No. 1, 41-46(Jan 1974). (In French).

In order to ensure a long term guarantee of the quality and availability of materials, EDF controls and surveys the operation of its suppliers. Both of these factors concern safety. The choice of materials and the execution of associated fabrication and control operations has led EDF to define appropriate legislation (text of regulations for fabrication and control) in conjunction with its suppliers. The application of this legislation has enabled, and even, stimulated appreciable technical progress in the field of water nuclear plant safety. (FR)

11980 STUDIES ON NUCLEAR SAFETY. Franzen, L. F. (Institut fuer Reaktorsicherheit der Technische Ueberwachungs-Vereine eV, Cologne). Atomwirt., Atomtech.; 19: No. 4, 202-203 (Apr 1974).

From annual colloquium 1973 of the nuclear safety project; Karlsruhe, Germany (11 Dec 1973).

The studies at the Kernforschungszentrum Karlsruhe in the field of reactor safety and radiation protection concentrate on the following main points: fuel element behavior in the loss-of-coolant accident, meltdown, dynamical loads, filter and adsorption systems, fission product propagation, nuclear environmental protection planning, decontamination, fuel cycle, problems of waste heat, and the information system for reactor safety. (GE)

11981 RESEARCH WORK CONCERNING THE SAFETY OF NUCLEAR POWER PLANTS. Sameith, H.; Schultheiss, G. F.; Smidt, D. (Univ., Karlsruhe, Ger.). Fridericiana; No. 13, 41-48(Nov 1973). (In German).

Three fields of reactor safety research, namely investigations of local coolant flow disturbances in a sodium-cooled fast breeder reactor, basic experiments concerning the behavior of two-phase mixtures in compression and expansion waves (LWR-accident with fast pressure drop), and development of an information system for reactor safety (RESI) are described. (GE)

11982 EVALUATION OF AIR TRAFFIC HAZARDS AT NUCLEAR PLANTS. Hornyik, K. (Oregon State Univ., Corvallis); Grund, J. E. Nucl. Technol.; 23: No. 1, 28-37(Jul 1974).

Analytic models have been developed and applied to investigate the hazards to a nuclear power plant from air traffic. Separate models applying to collisions with and crashes into the plant, respectively, employ concepts of traffic density and crash site distributions. These, along with the more conventional concepts of accident rates and effective plant area, are used to determine the annual strike probability of aircraft into safety-related plant structures. Although the models are quite general, they are applied to two specific flight patterns of common interest. The probability maps which are obtained may be used to resolve siting problems in a quantitative manner. 9 references. (auth)

11983 TECHNICAL ASPECTS OF THE SAFETY OF NUCLEAR INSTALLATIONS. Bourgeois, J. (Ministere du Developpment Industriel et Scientifique, Paris). Ann. Mines; No. 1, 21-26(Jan 1974). (In French).

The three different sectors concerned with the safety of nuclear plants are the constructor, the user, and the public. A frequent exchange of views between these three sectors is necessary during the research development, and exploitation stages. The safety of a nuclear reactor depends on the leak tightness of three or four barriers that must stop radioactive products from spreading to the exterior. An attempt was made to progressively introduce the concept of reliability and accident probability of a plant into France. Research is working to construct plants more economically and to diminish safety measures in cases where such measures are excessive. (FR)

11984 REACTOR HEAT TRANSFER. Proceedings of An International Meeting, Karlsruhe, Germany, October 9-11, 1973. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). 985p. (In Several Languages). (CONF-731020-).

Information is presented concerning one phase flow, mixing and turbulence promoters; one phase flow, convective single phase heat transfer; two phase flow; two phase flow critical heat flux; heat transfer problems related to fast reactor safety; and heat transfer problems related to thermal reactor safety. Separate abstracts are included for each of the 44 papers presented. (DCC)

For abstracts of individual papers see: 9433-9441, 11810-11814, 11827, 11828, 11843-11845, 11847, 11874-11887, 11915, 11930, 11985, 11986, 12012-12014, and 12021-12023.

11985 EXPERIMENTS AND ANALYSIS, BY THE METHOD OF CHARACTERISTICS ON LOSS OF COOLANT ACCIDENTS. Banerjee, S. (Atomic Energy of Canada Ltd., Pinawa, Manitoba); Jeffries, R. B.; Goulding, H.; Jaganathan, T. pp 870-892 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

An analysis of non-steady flow during a loss of coolant accident is presented. The equations for conservation of mass momentum and energy are solved, taking thermodynamic non-equilibrium into account, by the method of characteristics. Blowdown of multicomponent coolants (such as organic liquids) have also been analyzed by this method. Experiments were done in an out-reactor organic liquid cooled loop with several different flow geometries, heat input rates, rupture sizes and locations to check the analysis. Void fractions, pressures, coolant temperatures, heater surface temperatures and coolant discharge rate were measured as functions of time after rupture and compared well with analytical predictions. Blowdown data taken in an out-reactor water loop were also compared with the analysis and showed good agreement. (auth)

11986 MECHANISM OF HEAT TRANSFER AT A STRONG ACCIDENT IN THE REACTOR CORE. Zyszkowski, W. (Kernforschungszentrum, Karlsruhe, Ger.). pp 962-974 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Direct contact of hot molten fuel with comparatively cold coolant can occur during an accident situation in a reactor following fuel melting in one or more subassemblies. Rather small scale experiments were performed to investigate mechanisms of heat transfer during such a situation. An apparatus was built in which a small metal particle of about 0.5 grammes was heated above its melting point in a levitation coil. The temperature of the metal particle was regulated by changing the levitation time in the levitation coil. Next, the individual hot molten metal particle was dropped from a height of about 45 to 60 mm into a plexiglas vessel with about 10 to 50 cm^3 of cold fluid, and instantaneous contact with the fluid was observed. Interactions of copper droplets with water have been studied. The initial temperature of the copper was varied between its melting point and about 1800°C, and the temperature of water between 17°C and 80°C. The metal particle sank to the ceramic bottom and covered the Ni–NiCr thermocouple. The phenomenon was investigated in several geometrical configurations of the reaction zone. 6 references. (auth)

11987 TREATMENT OF RADIOACTIVE STEAM-GENERATOR BLOWDOWN. Greenway, W. R.; Klein, W. J.; Markind, J.; Stana, R. R. (NUS Corp., Pittsburgh). Ind. Water Eng.; 10: No. 2, 22-24(1973).

Early in the design of the 2 pressurized water reactors at Salem Nuclear Generating Station, it was recognized that primary-to-secondary side-steam generator leakage could add significantly to the station's volume of liquid radioactive waste. To provide greater operating flexibility in the event of such a leak, separate provisions for processing steam generator blowdown were considered. These processing methods included ion exchange, flash distillation, shell and tube distillation, and reverse osmosis. Boron removal was also considered. (Pollut. Abstr.)

11988 ACTUAL TEST OPERATION OF PWR PLANT. Test of No. 2 Unit in the Mihama Nuclear Power Station. Shibata, M.; Yamazaki, Y.; Nishimura, Y. (Kansai Electric Power Co. Inc., Osaka). Genshiryoku Kogyo; 19: No. 12, 19-27(Dec 1973). (In Japanese).

Taking the No. 2 unit of the Mihama nuclear power station as an example, the test operation of a PWR plant is described. The Mihama PWR plant is a two-loop type, with electric output of 500 MW(e). The following tests from fuel loading to the start of commercial operation are covered: fuel loading; precritical functions; first criticality; reactor physics at zero-power and power, and confirmation of parameters; transient response to one control-rod drop, load change, load cut-off, and loss of external power source; and plant performance. The first and second tests were made to prepare for criticality; the next two tests confirm various conditions to carry out power operation; and the last two obtain reactor plant characteristics at each power level, thereby ascertaining both performance and safety in rated-power operation. (JA)

11989 SAFETY OF ALTERATIONS IN REACTOR INSTALLATIONS (No. 1, 2, AND 3 PLANTS) OF THE KANSAI ELECTRIC POWER COMPANY'S MIHAMA POWER STATION. Genshiryoku Iinkai Geppo; 18: No. 1, 14-17(Jan 1973). (In Japanese).

The results of an investigation by the Reactor Safety Examination Committee of the AEC concerning the alteration of Mihama nuclear power station confirmed the adequacy in safety aspects. The items altered were the change of a ferroconcrete reactor containment vessel for No. 3 plant to a domed cylindrical structure, with an increase in the capacity of the annulus air recirculating facility; and a change in the area and shape of the station site and in the minimum distance from the reactors to the site boundary. Examination on the latter item, included exposure assessment in normal operation and hazard evaluation for No. 3 plant in accidents such as loss of coolant. (JA)

Reactor Theory and Calculation

Refer also to abstracts 11339, 11343–11347, 11349, 11586, and 11710.

11990 (AAEC/E-269) AUS MODULE POW: A GENERAL PURPOSE 0, 1 AND 2D, MULTIGROUP NEUTRON DIFFUSION CODE INCLUDING FEEDBACK-FREE KINETICS. Pollard, J. P. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Feb 1974. 129p. Dep. NTIS (US Sales Only) $9.50.

POW is a "workhorse" module of the AUS system and is used mainly for the following applications: (1) 2 region resonance theory data preparation from presently available fast reactor 26- or 16-group libraries, (2) 0, 1 and 2D diffusion calculations—eigenvalue or criticality search, source or feedback-free kinetics calculations, and (3) perturbation calculations. Main features of the code include the following: (1) it will run under the site AUS system or stand alone (on an IBM 360/50), (2) the code uses SLOR for inner iterations with region rebalance to enhance convergence, Gauss-Seidel for upscatter iterations with group rebalance to enhance convergence, Chebyshev source extrapolation for outer iterations and a delayed neutron integrated Crank-Nicholson method for kinetics problems, (3) free format style of input is used throughout, and (4) output options include 1 and 2D flux or reaction rate plots (on a CALCOMP plotter). (auth)

11991 (AAEC/E-307) ZHEX: A THREE-DIMENSIONAL DIFFUSION CODE FOR HEXAGONAL, Z GEOMETRY. Doherty, G. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1974. 34p. Dep. NTIS (US Sales Only) $4.75.

A description is given of ZHEX, a multigroup, finite difference diffusion code for hexagonal-z geometry. The code was written for an IBM 360/50 run in MVT mode using HASP and employs dynamic storage allocation, direct access data sets and some double precision arithmetic. The basic calculation block contains one plane of mesh points for one group so that core storage requirements are independent of the numbers of groups and axial planes. With the present overlay structure a 250 MW fast reactor requires 246K and a 1,000 MW fast reactor 342K. Calculation times are given for some realistic sample problems. (auth)

11992 (CEA-N-1695) PRACTICAL ON-LINE STUDY FOR ESTIMATING PARAMETERS USING THE KALMAN FILTER. Poujol, A.; Zwingelstein, G.; Marc, J. C. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Services d'Electronique). 25 Dec 1973. 125p. (In French). (CEA-SES-PUB-SAI-73-206). Dep. NTIS (US Sales Only) $9.50.

The purpose of the discrete Kalman filter equations is recalled. Some simple cases demonstrating the usefulness of the algorithm for the on-line estimation of parameters together with the main obstacles encountered are presented. A model is developed for simulating variations in the reactivity of a nuclear reactor. The corresponding source term for sub-critical conditions is then determined from neutron power measurements. The algorithm is then tested on the real process of estimating the temperature of the sodium of Rapsodie as well as the time constant of the system from thermocouple measurements, a Kalman filter being used. (FR)

11993 (COO-2262-4) ANNUAL PROGRESS REPORT, FY 1974. Hansen, K. F.; Henry, A. F. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Apr 1974. Contract AT(11-1)-2262. 36p. Dep. NTIS $5.00.

Information is presented concerning the development of numeral methods for the analysis of time dependent reactor dynamics. Areas of study include: numerical solution of finite difference approximations to kinetics problems; numerical solution for finite element approximations to kinetics problems; synthesis and similar methods for kinetics problems; and response matrix techniques. (9 references) (DCC)

11994 (EUR-5111) ISOTEX-1: A CODE FOR THE EVALUATION OF ISOTOPIC CONCENTRATIONS AND OF RATIOS OF CONCENTRATIONS. Sola, A. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). 1974. 96p. (In French). Dep. NTIS (US Sales Only) $8.00. EUR FB 125.-.

The code ISOTEX-1 computes the concentrations and ratios of concentrations of isotopes produced in a uranium and (or) a plutonium reactor. The units used for the calculation and the definition of the concentration ratios may be chosen by the user. The analytic solution of the differential equations describing the isotope transmutation schemes provides the values of the concentrations. The transmutation schemes, the heavy isotopes fission yields, the decay constants and the differential equations are presented. (auth)

11995 (EURFNR-1130) SNOW: A TWO-DIMENSIONAL SN PROGRAM FOR SOLVING THE NEUTRON-TRANSPORT EQUATION IN RECTANGULAR AND CYLINDRICAL GEOMETRY. Guenther, C.; Kinnebrock, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Jul 1973. 151p. (KFK-1826). Dep. NTIS $10.75.

Work performed under United States–Euratom Fast Reactor Exchange Program.

SNOW is a FORTRAN IV program for solving the two dimensional multigroup transport equation by the method of discrete ordinates (SN-method). The geometries of (x,y)-plane and (r,z), (r,θ)-cylinder, isotropic and anisotropic scattering and a lot of other special options are permitted. Three methods of convergence acceleration are incorporated. (auth)

11996 (FRNC-TH-456) CALCULATIONS OF RESONANT NEUTRON ABSORPTION BY URANIUM AND PLUTONIUM ISOTOPES IN A NUCLEAR REACTOR. Santamarina, A. (Paris-11 Univ., 91-Orsay (France)). 1973. 119p. (In French). Dep. NTIS (US Sales Only) $9.00.

Thesis.

The absorption of neutrons by heavy resonant isotopes in fuels was studied in view of investigating the slowing-down of neutrons in thermal neutron reactors. A method is described for classifying the cross sections of resonant isotopes from resonance parameters of the ENDF/B library. Studies of the resonant absorption of neutrons by uranium and plutonium isotopes led to the determination of the particular isotopes for which it is necessary to consider the self-shielding effect in slowing-down calculations and to classifications of the effective cross sections of ^{238}U, ^{235}U and ^{239}Pu from version II of the ENDF/B tape. The various comparisons made between the epithermal reaction rates calculated by APOLLO and CARPE simultaneously test the validity of the classifications made in relation to calculated cross sections and the use of the cross sections in APOLLO calculation of the slowing-down. Studies of $^{235}U-^{238}U$ and $^{239}Pu-^{238}U$ interactions led to an estimation of the error induced in the effective integral of an isotope when the presence of the other resonant isotope is neglected. Calculations on the mutual shielding effect enabled a figure to be obtained for the overall error made in the APOLLO multigroup cross sections and a definition to be determined for the fitted equivalent cross sections such that their utilization in the framework of the APOLLO calculations yields improved numerical results. Theoretical studies of the interaction effect led to a true definition of the equivalent cross section which takes the fine interaction of the different isotope resonances into consideration. This new formulation for the Bell factor and the protected multigroup cross sections thus preserves the overall reaction rate. (auth)

11997 (IAE-2238) COMPUTER PROGRAM FOR STEAM-GENERATING CHANNEL HYDRODYNAMIC STABILITY LIMIT CALCULATIONS WITH D-PARTITIONING METHOD. Lavrova, M. S.; Ivanchikov, V. M.; Gagarinskaya, I. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1972. 35p. (In Russian). INIS.

A program is proposed for calculating the required throttling which assured the stable operation of a steam-generating channel. Consideration is given to a steam-generating channel with the limiting condition Δp = constant, a condition which in practice corresponds to the case of a large number of parallel channels. There is a local resistance at the exit from the heated part. The purpose of the program was to determine the local resistance at the inlet required for hydrodynamic stability. The channel is considered as an automatic regulating system with a delay. As a basis of the program lies a method of D-splitting for a linearized model. (SJR)

11998 (IKE-4-8) CONVERGENCE ACCELERATION TECHNIQUES IN A TWO-DIMENSIONAL MULTIGROUP DIFFUSION CODE. Prinzhausen, F. (Stuttgart Univ. (TH) (F.R. Germany). Inst. fuer Kernenergetik). 2 Jul 1973. 164p. (In German). INIS.

Thesis.

From the multigroup diffusion equations of reactor theory one can obtain linear equation systems by discrete ordinate methods which are mostly solved iteratively. In particular, nonstationary methods are used to accelerate the convergence. The efficiency of these methods is tested for two reactor examples, and the iteration strategies are discussed. The methods presented were inserted in the two dimensional diffusion code 2 DB. (12 figures) (GE)

11999 (KFK-1632) PROGRESS IN FAST REACTOR PHYSICS IN THE FEDERAL REPUBLIC OF GERMANY. Kuesters, H. (comp.). (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik; Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F.R. Germany); Societe Belge pour l'Industrie Nucleaire, Brussels). Aug 1973. vp. (EACRP-U-46). INIS.

Progress in fast reactor physics in the Federal Republic of Germany during the years 1969 to 1972/73 is summarized. Research in the Nuclear Research Center of Karlsruhe is supplemented by investigations at INTERATOM, Bensberg and BELGO-NUCLEAIRE, and Brussels is explained. An assessment of target accuracies in the prediction of physical quantities of fast prototype power reactors is given, status of experimental and calculational techniques in fast reactor physics in 1969, improvements in theoretical fast reactor physics, improvements in experimental fast reactor physics, check of improved methods in integral experiments, results obtained in zero power facilities and their extrapolation for use in fast power reactors, status of the prediction of physics quantities in 1972/73, and general conclusions are presented. (GE)

12000 (RT/FI-(74)1) ANALYSIS AND CORRELATION OF MEASUREMENTS ON SNEAK AND ZPR VI FAST ASSEMBLIES BY THE ENDF/B VERSION 3 CROSS-SECTION DATA FILE. Gandini, A.; Petilli, M.; Salvatores, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jan 1974. 8p. (CONF-731015-7). Dep. NTIS (US Sales Only) $4.00.

From IAEA conference on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Estimates of group cross-sections are obtained by adopting a correlation method based on statistical theory. The starting data are represented by integral experiments obtained on the SNEAK (assemblies 7A and 7B) and ZPR VI (assembly 7) Pu-fueled fast critical facilities and by the ENDF/B (version 3) cross-section data files. The integral experiments considered are the following: K_{eff}, U-238 capture and fission and U-235 fission to Pu-239 fission rate ratios. An unfavourable χ^2 test seems to indicate the probable presence of inaccurate assessments of the initial error estimates. A few calculational checks have indicated however that this fact should not reduce the significance of the trends associated with the results. (auth)

12001 INVERSE KINETICS DETERMINATION OF SUBCRITICALITY. Yang, C. Y.; Albrecht, R. W. (Univ. of Washington, Seattle). Nucl. Technol.; 22: No. 3, 323-330(Jun 1974).

A highly efficient and bias-free inverse kinetics technique has been developed to determine the subcriticality of a nuclear reactor. The new algorithm has been tested through simulation studies against two other algorithms currently being used. It was also extensively tested by analyzing actual rod-drop experimental data taken at the Argonne National Laboratory. Both simulation studies and the real data analyses showed that the new algorithm is a superior method in estimating the subcriticality of a system from the time-dependent neutron flux transient data. (auth)

12002 CALCULATION OF INNER-GROUP FAST NEUTRON SPECTRA. Gurin, V. N.; Dmitrieva, V. S.; Rumyantsev, G. Ya. Sov. J. At. Energy (Engl. Transl.); 34: No. 4, 356-357(Apr 1973).

Translated from At. Energ. (USSR); 34: No. 4, 288(Apr 1973).

A method for the calculation of neutron spectra in fast reactors is presented. Some calculated spectra are compared with measurements from fast assemblies. (JWR)

Reactor Components and Accessories

Refer also to abstracts 10223, 10372, 10377, 10389, 10393, and 11940.

12003 (JUL-1008-RX) GAMMA DOSIMETRY IN NUCLEAR REACTORS. Jeltsch, E.; Graf, W. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany). Zentralinstitut fuer Reaktorexperimente). Oct 1973. 20p. (In German). Dep. NTIS (US Sales Only) $4.00.

Gamma dosimeters suitable for use in reactor cores are reviewed. With the methods described, measurements up to 10^{11} rad are possible. Whereas in the range of lower doses different methods are available, only teflon dosemeters are suitable for the determination of high dose values. (GE)

12004 (ORNL-TM-4211) STRESS INDICES AT LUG SUPPORTS ON PIPING SYSTEMS. Rodabaugh, E. C.; Dodge, W. G.; Moore, S. E. (Oak Ridge National Lab., Tenn. (USA)). May 1974. Contract W 7405-eng-26. 88p. Dep. NTIS $5.45.

Stress indices and the appropriate simplified design formulas are developed for analyzing integral lug attachments on straight pipe according to the philosophy of Section III of the ASME Boiler and Pressure Vessel Code for Class I Piping Systems. Indices are developed for the evaluation of primary stresses, primary-plus-secondary stresses, and peak stresses due to internal pressure in the pipe; for radial thrust and transverse shear forces and torsional and bending moment loads acting on the lug; and for a thermal gradient between the pipe and the lug. The indices for thrust and bending moment loads are based on an extensive parameter study and are represented by simple formulas that may be used directly by designers and/or incorporated into codes and standards. From comparisons with other methods of analysis these formulas are considered to be more accurate and easier to use. Indices for the other loadings are based in part on strength-of-materials theory and information in the literature. Specific recommendations are made for incorporating the stress indices and design formulas into the ASME Code. As an example, a simple pipe support design is analyzed using the recommended formulas. (auth)

12005 (RDT-E-15-2-T(5-74)) REQUIREMENTS FOR NUCLEAR COMPONENTS. (Supplement to ASME Boiler and Pressure Vessel Code, Section III). (USAEC Division of Reactor Research and Development, Washington, D. C.). May 1974. 44p.

Supplemental requirements for the construction of pressure containing components of water cooled power reactors are presented. (FS)

12006 HEAVY EQUIPMENT FOR NUCLEAR POWER PLANTS. Lefebvre de Ladonchamps, J. (Societe Franco-Americaine de Constructions Atomiques, Courvevoie, France). Rev. Fr. Energ.; 25: No. 257, 125-135(Oct 1973). (In French).

The solutions adopted by French industry to provide itself with the facilities for fabricating and testing heavy components for nuclear plants are presented. Problems connected with the fabrication of PWR boilers (vessels, steam generators, primary pumps and mechanisms for controlling the clusters) are considered. Simplifications made to BWR boilers by using single heat exchange systems are compensated by the size of the vessel used. Problems encountered by the constructors of turbo-alternators and transformers as a result of power increases and developments in the steam characteristics exploited are examined. (FR)

12007 PRESSURE VESSEL TECHNOLOGY. Part III. Discussions. Second International Conference Held at San Antonio, Texas, October 1–4, 1973. New York; American Society of Mechanical Engineers (1974). 355p. (CONF-731003-P3). $20.00.

Separate abstracts are included for each of the 11 papers presented concerning pressure vessel materials and fabrication. Discussion sessions and brief technical notes were not abstracted for NSA. (DCC)

For abstracts of individual papers see: 9447, 10389–10394, 10441, 11808, 12008, and 12009.

12008 DESIGN ASPECTS OF HIGH DUTY PRESSURE COMPONENTS. Latzko, D. G. H. (Delft Univ. of Tech, Netherlands). pp 41-48 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

The stress analysis requirements for nuclear reactor pressure vessels are reviewed. The pressure vessel material, configuration, and reactor operating parameters are considered. 19 references. (DCC)

12009 DESIGN OF PRESSURE VESSELS FOR ELEVATED TEMPERATURE SERVICE. Berman, I. (Foster Wheeler Corp., Livingston, NJ). pp 49-62 of Pressure Vessel Technology. III. New York; American Society of Mechanical Engineers (1974).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P3.

Design of high reliability nuclear components for use at elevated temperatures is considered. The design is related to the design of structures at lower temperatures and structures with lesser reliability requirements. The application of Design by Analysis is considered in some detail. It is concluded that procedures in addition to Design by Analysis are required for reliable results at elevated temperatures. Some approaches are suggested. 10 references. (auth)

12010 REACTOR-FUEL ASSEMBLY HOLD DOWN. West, J. M. (to Combustion Engineering Inc.). US Patent 3,801,734. 2 Apr 1974. Filed date 23 Dec 1971. 16p.

Vertical motion of nuclear reactor fuel element bundles is limited by tubular pistons which engage fuel assembly upper end fittings to urge the fuel assemblies in the vertically downward direction. The tubular pistons are provided with mechanical stop means to limit their vertical motion and are disposed within guide tubes which extend between the reactor core fuel alignment plate and upper guide structure. (Official Gazette)

12011 SEAL RING FOR NUCLEAR REACTORS. Fryer, E. R. US Patent 3,812,008. 21 May 1974. Filed date 20 May 1970. 4p.

An inflatable seal ring for use between the annular surface of a nuclear reactor vessel and its surrounding biological shield, which forms part of the housing for the reactor vessel. The seal is used during refueling of the vessel to prevent water maintained in the refueling canal above the reactor vessel from entering the reactor cavity. (Official Gazette)

12012 FILM THICKNESS AND FLOW BOILING FOR TWO-PHASE ANNULAR FLOW IN HELICALLY COILED TUBES. Kozeki, M. (Mitsui Shipbuilding and Engineering Co., Ltd., Tokyo). pp 351-372 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Experiments on the local film thickness measured by the needle contact method in the air-water system, experiments on the flow boiling local heat transfer in the steam-water system and the theoretical investigations on the film thickness and boiling heat transfer in the annular two-phase flow in the helically coiled tube are presented. The experimental and the theoretical results are compared and discussed. 7 references. (auth)

12013 MEASUREMENT OF THE TEMPERATURE NOISE SIGNAL AT THE FUEL ELEMENT OUTLET FOR DETECTION OF COOLANT CHANNEL BLOCKADES. Krebs, L.; Weinkoetz, G. (Kernforschungszentrum, Karlsruhe, Ger.). pp 728-746 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In German)

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Two series of studies were made to determine the feasibility of using measurement of the temperature noise signal to detect blockades of the coolant channel. In the first series these signals were detected at 18 BE outlet positions distributed over the core of the compact sodium-cooled nuclear reactor installation. In the second series, studies were made on electrically heated fuel elements in an out-of-pile Na loop. The two series of experiments gave comparable results and showed the dependence of the noise signal on the position of the fuel element in the core. It was concluded that the square average of the temperature fluctuation obtained from the Parseval relation by integration over the total power spectrum is a direct measurement of the thru-put. 4 references. (tr-auth)

12014 SOLUTIONS ALLOWING THE CONTROL OF FUSED FUEL AFTER AN ACCIDENT. Antonakas, D. (CEN, Cadarache, France); Francois, P. pp 851-868 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973). (In French)

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

In order to devise a system for the control of fused fuel after an accident, the mass and temperature of the fused fuel, the level of residual power, and the migration of the fuel between the core and the bottom of the vessel must be known. The characteristic methods for the recovery of the fused fuel are analyzed. The injection of a coolant in the intervessel space which favors the transfer of heat between the two vessels is analyzed as one possible solution for the removal of heat. In appendices the thermal exchange is evaluated for the use of a core catcher and for the case when the bottom of the vessel will serve to collect the fused fuel. (JSR)

12015 NEW DEVELOPMENTS FOR NUCLEAR ENGINEERING. Breyer, K. Herion-Inform.; No. 4, 112-116(1973). (In German).

On nuclear reactors, safety is far more important than in other branches of the industry. Valves operating without glands and passages are described. The solenoid valves are designed so that a high quality of tightness to the outside is combined with simple handling. The application of such devices is, of course, not limited only to reactor engineering but offers advantages in conventional power plants, too. (GE)

Reactor Fuels

Refer also to abstracts 9265, 9268, 9270, 9271, 9273, 10219, 10222, 10258, 10470, and 10500.

12016 (CEA-CONF-2507) SUMMARY OF STUDIES BY BELGONUCLEAIRE AND THE CEA ON THE IMPROVEMENT AND STANDARDIZATION OF THE COMETHE CODE USING RESULTS OF IN-PILE EXPERIMENTS. de Meulemeester, E.; Hoppe, N.; de Contenson, G.; Watteau, M. (Societe Belge pour l'Industrie Nucleaire, Brussels; CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). 1973. 40p. (In French). (CONF-731004-11). Dep. NTIS (US Sales Only) $5.00.

From international conference on nuclear fuel performance; London, UK (15 Oct 1973).

COMETHE is a computer code used to predict the in-pile mechanical and thermal behavior of metallic-clad pins filled with fritted ceramic fuel. The code is used for the pins of fast neutron and ordinary water reactors. The studies made for the improvement and standardization of the code using the results of in-pile experiments are presented in a systematic fashion. The results show that COMETHE, in its operating version COMETHE III, gives results in good agreement with experimental data. (JSR)

12017 (WAPD-TM-1124) FISSION GAS SWELLING AND LONG RANGE MIGRATION AT LOW TEMPERATURES. Dollins, C. C. (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Jan 1974. Contract AT(36-1)-Gen-14. 26p. Dep. NTIS $4.50.

Fission gas behavior at temperatures below ~1100°C is assumed to consist of gas bubble nucleation and coalescence through random motion of the bubbles and then complete bubble destruction by subsequent fission events. A model is proposed describing the gas behavior based on a modified form of Van der Waal's gas law for very small bubbles. A bubble is assumed to move inversely to the cube of its radius. Long range migration of gas bubbles to grain boundaries is also predicted and the swelling due to gas motion in the grain boundaries is calculated. (auth)

12018 MULTI-ROD CLUSTERS FOR REACTOR PHYSICS EXPERIMENTS. Menzes, P. F. (Calico, Chemicals, and Plastics Div., Bombay); Rose, A. J. Inst. Eng. (India); 51: No. 8, 217-222(Apr 1971).

An experiment conducted to determine fast fission factor for different multi-rod fuel assemblies is reported. The design, fabrication, assembly and handling of these multi-rod clusters are described. In all, 6 types of clusters—two of 7 rod, two of 19 rod and one of 37 rod and one of 61 rod clusters have been investigated. (INIS)

12019 METHOD OF MAKING A CARBIDE–GRAPHITE COMPOSITE NUCLEAR FUEL. Martin, W. W.; Schell, D. H.; Taub, J. M. (to United States Atomic Energy Commission). US Patent 3,810,962. 14 May 1974. Filed date 25 Aug 1972. 4p.

Composite nuclear fuel materials are described of the formula (U, Zr) C–C in which the ratio of U to Zr can be varied over rather wide ranges without significantly altering physical characteristics, as long as the overall carbide content is held constant. Optimum characteristics for fuel elements useful in nuclear propulsion reactors are exhibited by the composites containing 30 to 35 vol. per cent carbide. Fuel elements of these composites are readily made by blending ZrC powder, UO_2 powder, graphite flour, carbon black, and a thermosetting resin in the appropriate ratios to provide the desired final produce, extruding in a desired shape, curing, and subjecting the cured extrusion to a high-temperature heat treatment. (Official Gazette)

12020 PRODUCTION OF POROUS CERAMIC NUCLEAR FUEL EMPLOYING DEXTRIN AS A VOLATILE PORE FORMER. Steele, B. R. (to United Kingdom Atomic Energy Authority). US Patent 3,812,050. 21 May 1974. Priority date 13 Jan 1972, United Kingdom of Great Britain and Northern Ireland. 2p.

To produce low density sintered uranium dioxide fuel pellets uranium dioxide powder is mixed with dextrin which is removed during subsequent sintering of pellets formed from the mixture. (Official Gazette)

12021 ASSESSMENT OF HEAT CONDUCTION EFFECTS ON THE HEAT TRANSFER PERFORMANCE OF A TWELVE START HELICALLY RIBBED SURFACE. Barnett, P. G.; Young, C. N. (United Kingdom Atomic Energy Authority, Windscale, Eng.). pp 63-86 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

The heat transfer coefficient distribution for a particular twelve start helically ribbed surface is presented together with calculations relating to out-of-pile heat transfer tests and the adjustments necessary to obtain reactor predictions. The information obtained is compared with earlier results for a particular transverse ribbed surface. 5 references. (auth)

12022 PRESSURE DROP AND HEAT TRANSFER IN PARALLEL CHANNELS WITH DETACHED WIRE PROMOTERS. Hishida, M. (Japan Atomic Energy Research Inst., Tokai); Okamoto, Y.; Seki, M. pp 134-154 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

Heat transfer and pressure drop in the parallel channel with staggered promoter wires on both side walls were measured by an atmospheric wind tunnel. Experimental results are presented. 5 references. (auth)

12023 PRESSURE DROP PERFORMANCE OF ARTIFICIAL ROUGHNESS AS A FUNCTION OF ROUGHNESS GEOMETRY. Baumann, W. (Gesellschaft fuer Kernforschung, Karlsruhe, Ger.). pp 155-178 of Reactor Heat Transfer. Dalle Donne, M. (Ed.). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1973).

From international heat transfer meeting; Karlsruhe, F.R. Germany (9 Oct 1973). See CONF-731020-.

An investigation concerning channel flow with artificial wall roughness has been made using published values of friction coefficients and Reynolds numbers. For consideration the data have been based on uniform geometrical characteristics which were calculated volumetrically as proposed by NIKURADSE and SCHLICHTING. It was shown that universal relations exist between the roughness parameter R and the roughness geometry although there were different qualities of the published values and the experimental conditions often were not clearly defined. 38 references. (auth)

Reactor Control Systems

Refer also to abstract 11831.

12024 (JUL-1018-HT) CONTROL ROD AND LOAD CRITERIA FOR A PRISMATIC HIGH-TEMPERATURE REACTOR. Dworak, A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). Nov 1973. 73p. (In German). Dep. NTIS (US Sales Only) $6.75.

Thesis. Submitted to Technische Hochschule, Aachen (West Germany).

The method of calculating the control rod worth by means of diffusion theory using extrapolation lengths is checked against an experiment performed with the freshly loaded Dragon Reactor Core, First Charge Core 1. Good agreement between experiment and theory was achieved by using the following method. In a cell calculation where the control rod has its actual geometry, the energy-dependent absorption rates are evaluated by using the extrapolation lengths calculated for this geometry. In a second cell calculation, the control rod has the same shape as the "non-diffusion region" in the 2-D reactor calculation. The extrapolation lengths will have to be corrected in such a manner that the absorption rate in each energy group has the same value as in the original cell calculation. This method was used for control rod design and core-performance calculation for a "low-enriched–on-load" power reactor design. It was shown that the control rods fulfill all safety criteria and that the grey control rods are effective in flattening local peaks. An "on-load" refueling scheme was worked out, which assured at any time an almost flat power distribution. Further calculations were done under the aspect of a reload error which showed that the grey control rods can cope with even very high local power peaks. (GE)

12025 (MRR-131) CONCEPT OF DIGITAL CONTROL IN REACTOR TECHNOLOGY. Beraha, D. (Technische Univ. Muenchen, Garching (F.R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Oct 1973. 105p. (In German). Dep. NTIS (US Sales Only). $8.25.

After a short introduction to the main ideas and methods of modern control theory, a survey of important papers on the subject of modern reactor control is given. These new developments are then discussed in the light of reactor safety. (auth)

12026 (TID-25952-P2) NUCLEAR POWER REACTOR INSTRUMENTATION SYSTEMS HANDBOOK. Volume 2. Harrer, J. M.; Beckerley, J. G. (eds.). (Argonne National Lab., Ill. (USA); USAEC, Washington, D. C.). 1974. 282p. Dep. NTIS $7.60.

Information is presented which is intended for the designers and operators of power-reactor instrumentation systems. All systems are discussed including the problems associated with integrating individual components into subsystems and systems. Systems associated with the electric power generated and with generator operation are not discussed. The importance of the reactor protection system and personnel monitoring are described in detail. The status of standards and codes on nuclear reactor instrumentation systems is included. The current state of the art in instrumentation for pressurized-water, boiling-water, gas-cooled, and sodium-cooled reactors is summarized. (FS)

12027 (WCAP-8255) NUCLEAR INSTRUMENTATION SYSTEM. Lipchak, J. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Jan 1974. 64p.

The Nuclear Instrumentation System (NIS) is an integral part of the nuclear steam supply system provided for Westinghouse pressurized water reactor power plants. It monitors the power level of the reactor at all times and is used primarily for plant protection. It also provides appropriate alarm functions during plant operating and shutdown conditions. In addition it provides a secondary control function, and indicates reactor status during start-up and power operation. The three overlapping ranges of instrumentation (source, intermediate and power) provide over-power trip protection at increasing levels during startup and at power operation. A functional description of the standard nuclear instrumentation system used on all Westinghouse PWR plants is provided. The sensor types and the signal processing equipment for each of the channels are described. (auth)

12028 STRUCTURE AND FUNCTION OF THE PROCESS COMPUTER PROGRAM SYSTEM READAT. Friedrich, G. (Draftwerk Union AG, Erlangen, Ger.); Hurtienne, E.; Zaiss, H. W. Siemens-Z.; 47: No. 11, 775-779(Dec 1973). (In German).

A system of process computer programs has been plotted for the controlling and recording of nuclear process cycles for pressurized water reactors. To solve a limited task, the necessary programs have formed a program element. The essential functions of this element are the acquisition and evaluation of the measured values from the stationary incore instrumentation, from the aeroball measuring system, from the control rod positions and from transmitter analogues in both primary and secondary cycles. The calculated parameters are expressed in terms of individual information, lists, tables, graphs or according to core cross sections. Special condition programs enable the start of programs and the input and output of measured data. Furthermore, there are a few independent reactor type elements within READAT, e.g. elements to record and evaluate data of analysis equipment. (GE)

12029 TEMPERATURE CONTROL AND EMERGENCY PROTECTION AGAINST PERILOUS TEMPERATURES IN NUCLEAR REACTOR. Strnad, M.; Sourek, J ; Voles, J. Czech Patent 146,450. 15 Dec 1972. 2p. (In Czech).

A temperature control and emergency protection system against perilous temperatures in a nuclear reactor is proposed. The system is based on the use of temperature sensing probes operating on the principle of phase transformation of substances. The sensors are located at the inlets of the control and protection system loop. The system eliminates the disadvantages of currently used thermocouples and resistance thermometers, such as rapid aging, the need of frequent calibration and of complex and expensive compensating circuits, as well as of stabilized sources of reference voltage and temperature. (INIS)

12030 DRIVING MECHANISM FOR NUCLEAR REACTOR CONTROL ELEMENTS. Maslenok, B. A.; Glushkov, A. T.; Zlobin, V. G.; Khegai, A. S.; Petrichenko, N. F Czech Patent 146,487. 15 Dec 1972. 4p. (In Czech).

A driving mechanism was proposed for control rods located above a reactor. In comparison with well-known devices, the connection proposed ensures high freedom of motion of the elements. It effects an easy, prompt, and reliable connection and disconnection between the drive unit and the control element. (INIS)

12031 TIMING UNITS FOR REACTOR SAFETY WITH PROCESSING CONTROL COMPUTERS. Schueller, H. (Technische Univ., Minich); Ehrenberger, W.; Biegel, H. Elektronik (Munich); 22: No. 11, 387-390(Nov 1973). (In German).

There are only two possibilities for safety circuits: either they must work properly, or they must fail in such a manner that nothing happens i.e., "fail-safe-technique." In designing such a circuit, the right way is hard to find. The difficulties should neither be under nor overestimated. The present problem and solution from the reactor safety technology is a good test case of the technique of safety circuits, its regulations can thus also be well applied to other cases. (GE)

12032 EXPERIMENTS OF ANOMALY DETECTION SYSTEM OF A REACTOR CORE. Ohsawa, Y. (Atomic Energy Research Lab., Japan); Kato, K.; Oyamada, R. Nucl. Technol.; 23: No. 1, 5-13(Jul 1974).

An anomaly detection system (ADS) for a reactor core was installed in the Japan Materials Testing Reactor and its performance was tested. The ADS has the following functions: to detect anomalous conditions in the reactor core by use of a reactivity balance method; and to identify the cause of a detected anomalous condition by comparing signal pattern with predetermined reference signal patterns. The experimental results show that the ADS detects about 2 cents worth of reactivity of anomaly in the reactor core and identifies nine different causes of anomaly within 1 sec after sampling reactor signals. 4 references. (auth)

Nuclear Power Plant Economics

Refer also to abstract 11834.

12033 (AECL-4767) CANADIAN NUCLEAR POWER PROGRAM. A Brief to the Science Council of Canada. (Atomic Energy of Canada Ltd., Chalk River, Ontario). Apr 1974. 38p. Dep. NTIS (US Sales Only) $5.00. AECL $1.00.

Canada has a commercially viable and extremely successful nuclear power reactor program that has assured its position among those advanced nations that are reaping the benefits of the peaceful exploitation of nuclear power. The Canadian program and the world picture of nuclear power development are discussed. The Canadian program is traced through its present status to the long-term options that will maintain its position as a source of very low cost electricity. (CA)

12034 (ORNL-TM-4443(Rev.1)) COLLECTION OF PAPERS PRESENTED AT THE NUCLEAR UTILITIES PLANNING METHODS SYMPOSIUM, CHATTANOOGA, TENNESSEE, JANUARY 16-18, 1974. (Oak Ridge National Lab., Tenn. (USA)). May 1974. (Contract W-7405-eng-26. 605p. (CONF-740102-). Dep. NTIS $33.25.

Separate abstracts are included for 2 of the 31 papers presented concerning the optimum operation of nuclear and fossil fueled power plants. The remaining 29 papers have been previously included in NSA and can be found in the Report Number Index under ORNL-TM-4443. (DCC)

For abstracts of individual papers see: 11819 and 12046.

12035 (PB-228067) RESEARCH APPLIED TO OCEAN SITED POWER PLANTS. Annual Progress Report, January 1-December 31, 1973. Anderson, J. H. (Massachusetts Univ., Amherst (USA)). 25 Jan 1974. 74p. (NSF-RANN-74-2).

One total system configuration for a 400 MW(e) Ocean Thermal Power Plant has been conceptualized. Enough work has been accomplished to show that that concept could be replicated in a broad swath in the Gulf Stream along the U. S. southeast coast. Subsystems have been reduced to diagrams and major components have been sized. More time is required to reduce the heat exchangers to detail adequate for cost estimation. A complete math model of the total heat engine cycle has been created and parametric studies are now possible with reasonable computer time expenditures. Prospects for economic ocean thermal power plants look very good. State-of-art solutions to remaining problems can be made. One 1100 MW(e) submerged nuclear power plant has been arranged and balanced. The condenser plume has been described. The mechanics and design methods for very thick large diameter cylindrical and spherical pressure hull shells of reenforced concrete have been elaborated. The nuclear power plant project will be abandoned after 1 Jan. 1974. Redirection of this project to large offshore coal burning plants is suggested. (auth)

12036 (PB-228070) RESEARCH APPLIED TO OCEAN SITED POWER PLANTS. Semi-annual Progress Report, January 1, 1973-June 30, 1973. Anderson, J. H. (Massachusetts Univ., Amherst (USA)). 31 Jul 1973. 72p. (NSF-RANN-73-456).

Additional subsystem and component sizes have been produced for the Ocean Thermal Power Plant. The math model of the cycle calculates effects from single or group parameter variations. Results are given in terms such as overall thermal efficiency, size and cost. Efficiencies close to 2.0% are indicated for a 32FΔt. Three working fluids remain competitors. One Total System Configuration is in use as a common denominator for all research effort; other configurations are under study. Prospects for economic thermal plants look very good. Solutions to remaining major problems appear to be state-of-art. One 1100 MW(e) submerged nuclear power plant has been arranged and balanced. The condenser exhaust plume has been described for one circular cross section discharge nozzle. New design techniques applicable to thick large diameter concrete cylindrical and spherical pressure hull shells have been elaborated. Two major problems seem to cloud the prospect for application of moored plants: (a) LWR plant costs have escalated so drastically that economics are borderline, and (b) this team lacks expertise needed to identify reactor compartment shell material that would contain a meltdown. Redirection of this project to large offshore coal burning plants is suggested. (auth)

12037 (WASH-1316) NUCLEAR POWER PLANT AVAILABILITY AND CAPACITY STATISTICS FOR 1973. Thompson, D.; Bell, L. G. (USAEC Directorate of Regulatory Operations, Washington, D. C.). May 1974. 8p. Dep. NTIS $4.00.

Statistical information concerning nuclear power plant availability, plant capacity and reactor availability factors for 1973 was compiled from semiannual reports submitted to the USAEC. Plant availability during 1973 was slightly lower than that reported for 1972. A previous observation concerning attainment of, and continued performance at, 80% availability after three to four years of operation was not substantiated by experience during 1973, because extensive outages at a few plants strongly influenced the average figures for the small number of plants that have been in operation for three years or more. Plant availability and capacity factors for nuclear power plants are comparable to those reported elsewhere for fossil-fueled power plants of comparable sizes and ages. (auth)

12038 ATW: STATISTICS. Nuclear Power Stations 1973. A World Review. Atomwirt., Atomtech.; 19: No. 3, 130-132 (Mar 1974). (In German).

The most important data are summarized in 4 tables: 1) Nuclear power plant statistics of the western world according to reactor manufacturers. 2) Nuclear power plants of the world according to countries. 3) Nuclear power plant commissions in 1973 (including letters of intent) according to manufacturer. 4) Generation of electricity of the nuclear power plants of the world in 1973. Standing of the data is 31.12.1973. (GE)

12039 MARKET POTENTIAL FOR NUCLEAR POWER PLANTS IN DEVELOPING COUNTRIES. Report on the Market Survey Made by the IAEA. Wolte, G. (International Atomic Energy Agency, Vienna). Atomwirt., Atomtech.; 19: No. 4, 198-201(Apr 1974). (In German).

In 14 developing countries, the IAEA undertook a market survey of the nuclear power plants that might be commissioned in these countries during the period 1980-1989. The major objective of this survey was to determine the size and timing of nuclear power plants that could, on economic grounds, justifiably be built in these countries as an alternative to conventional power plants, and to determine the sensitivity of this market to selected economic parameters. The data have been analyzed and forecasts have been made of the energy requirements to be met by the power generating systems in these countries up to the year 2000. The results and information contained in this study have to be considered rather critically, particularly because the recent development on the world's energy market as a consequence of the oil crisis has brought about a change in the overall situation with regard to the competition between oil and nuclear power as energy resources. But even taking into account this change of situation and assuming a possible greater need for nuclear power, the figure given for the nuclear power plant capacity probably to be installed in these developing countries by 1989 (a total of 55,000 MWe) seems to be rather optimistic. (GE)

12040 REPORT ON BUILDING PROJECTS AND PROJECTS IN EUROPE. I. New Nuclear Power Stations in the Federal Republic of Germany. Atomwirt., Atomtech.; 19: No. 4, 183-197(Apr 1974). (In German).

In the Federal Republic of Germany, 10 nuclear power stations totalling 2,400 MW(e) output have been commissioned. Another 10 nuclear power stations with an aggregate capacity of 9,092 MW(e) are under construction. Eight of these plants are large commercial stations (Biblis A, 1,200 MW, PWR; Biblis B, 1,238 MW, PWR; KKB Brunsbuettel, 805 MW, BWR; KKP-1 Philippsburg, 900 MW, BWR; KKI Isar, 907 MW, BWR; KKU Esenshamm, 1,300 MW, PWR; GKN Neckarwestheim, 805 MW, PWR; KKK Kruemmel, 1,316 MW, BWR). If the number of planned nuclear power stations is restricted to the concrete projects whose construction is imminent, there are another 9 projects to be added totalling 10,546 MW capacity, all of which are scheduled to begin operation by 1980 at the latest. (GE)

12041 OPERATING EXPERIENCE WITH GERMAN NUCLEAR POWER PLANTS. Bachl, H. (Stadtwerke, Munich). Atomwirt., Atomtech.; 19: No. 3, 148-151(Mar 1974). (In German).

In the study "Proposals for the forming of an economical, operational and least harmful to the environment nuclear power plant with high-temperature reactor and gas turbines," the present operational experience was investigated in German nuclear power plants, in order to make predictions on the time-nonavailability of future power plants with various reactor types and on their economics. (GE)

12042 NUCLEAR ENERGY DEVELOPMENT PREDICTIONS. Grenon, M. Rev. Fr. Energ.; 25: No. 257, 241-247(Oct 1973). (In French).

The developments foreseen by the United States Atomic Energy Commission in the field of world nuclear energy up to the year 2000 are analyzed. Increase in the electronuclear capacity available, parameters characteristic of reactors, fuel cycles, enrichment and natural uranium requirements are discussed. (FR)

12043 NUCLEAR ENERGY AND DEVELOPING COUNTRIES. Atoomenerg. Haar Toepass.; 16: No. 3, 62-66(Mar 1974). (In Dutch).

Results of an IAEA survey made in 1973 are summarized. One important conclusion is that many developing countries should have a strong economic incentive to expand nuclear installations to the point where 70-75% of their electricity is nuclear-generated by 1990. However, as is brought out by detailed tabulations, there are quite wide variations in the individual development potentials of the 14 countries covered by the survey. (NL)

12044 ENERGY POLICY ROLE OF NUCLEAR POWER. Lantzke, U. (Bundesministerium fuer Wirtschaft, Bonn). Energiewirt. Tagesfragen; 24: No. 1-2, 3-6(Jan 1974). (In German).

The problems of conventional energy carriers, the growing importance of nuclear energy, the problems in building and operating nuclear power plants, the competition in nuclear power plant building, as well as the nuclear fuel cycle are briefly discussed. (GE)

12045 PROBABILISTIC THEORETICAL MODELS FOR THE DETERMINATION OF THE AVAILABILITY OF POWER PLANTS. An Investigation of Basic Conditions and Assumptions. Trautmann, K. (Technische Univ., Darmstadt, Ger.). Elektrizitaetswirtschaft; 73: No. 1, 3-8(Jan 1974).

The associations of the German electricity industry have been successful in the last few years in their efforts toward a standardization of the registration and documentation of structural component failures in power plants, yielding information about the principal causes of failures and thus contributing to an immediate increase in the availability of power plants as a result of appropriate technical improvements. This does not exclude the possibility of contingent failures of power plant units and hence calls for a statistical assessment of the availability of a system of power plant units within the interconnected system of the electric utilities, and the problems associated with the supply of the required standby power. The main methods and procedures proposed in the various reports from the statistical and methodical point of view were investigated on the basis of a single power plant unit as the smallest statistical unit. (GE)

Reactor Fuel Cycle Economics

Refer also to abstracts 9669, 11819, and 12033.

12046 (ORNL-TM-4443(Rev. 1), pp vp, Paper 29) UBID-LP: URANIUM BID EVALUATIONS USING LINEAR PROGRAMMING. Lee, J. C. J.; Hoskins, R. E. (Tennessee Valley Authority, Chattanooga). May 1974.

From nuclear utilities planning methods symposium; Chattanooga, Tennessee, USA (16 Jan 1974).

In collection of papers presented at the nuclear utilities planning methods symposium.

UBID-LP is a computer model developed to aid in evaluating uranium bids and planning the optimum utilization of uranium resources to meet total power system needs. The use of a linear programming optimization procedure represents a substantial improvement over a systematic limited search technique used in an earlier model. The model structure consists of the following five segments or modules: requirements module written in PL/1; cost matrix module written in PL/1; LP input interface module and matrix generator written in FORTRAN; linear programming module using IBM-MPSX system; and LP output interface and report writer module written in FORTRAN. (6 references) (auth)

12047 FRENCH NUCLEAR FUEL CYCLE INDUSTRY. Taranger, P. (CEA, Chatillon, France). Rev. Fr. Energ.; 25: No. 257, 109-116(Oct 1973). (In French).

The present situation and the future envisaged for French industry in the different stages of the fuel cycle are reviewed: as to production of concentrates and uranium conversion, uranium enrichment, industrial fabrication of fuel elements, and reprocessing of irradiated fuels. The position held by French industry in the face of world competition is described. The importance of the facilities and advantages of which French industry defines industrial policies to meet competition and customer requirements at both national and international levels is discussed. (FR)

Reactor Licensing and Regulation

12048 (DOCKET-50254-395) QUAD-CITIES STATION, UNITS 1 AND 2. First Year Operating Report. (Commonwealth Edison Co., Chicago, Ill. (USA)). 10 May 1974. 85p. (DOCKET-50265-347). Dep. NTIS $7.25.

The reactors operated safely and reliably during their first year of operation. Unit 1 produced over 632,000 MWd of thermal power and Unit 2 produced over 693,000 MWD thermal power. Information concerning the safety analysis; performance of safety-related structures, systems, and equipment; start-up test results; loss of off-site power; relief valves; operating license review; and the AEC safety analysis is presented. (FS)

12049 (DOCKET-STN-50482-1) WOLF CREEK GENERATING STATION, UNIT 1. License Application, (Kansas Gas and Electric Co., Wichita (USA)). 29 Mar 1974. 70p.

The Wolf Creek facility will be a PWR capable of an output of 3425 MW(t) which includes a 14 MW(t) contribution from the coolant pumps. This corresponds to a net electrical capability of about 1180 MW(e). All physics and core thermal hydraulics information is based on a reference core design of 3411 MW(t). Site parameters, containment, engineered safeguards, and hypothetical acci-

dents are evaluated for a core output of 3579 MW(t). Wolf Creek Generating Station will be located approximately 3½ miles northeast of Burlington in Coffey County, Kansas. The site is about 3.6 miles east of the Neosho River and the spillway at the John Redmond Reservoir, 75 miles southwest of Kansas City, Kansas, and 100 miles northeast of Wichita, Kansas. (FS)

12050 (FIND-50220) FIND: NINE MILE POINT NUCLEAR STATION, UNIT 1. Items 1-232. Carter, E. P. (ed.). (USAEC Technical Information Center, Oak Ridge, Tenn.). Apr 1974. 24p. Dep. NTIS $4.00.

A guide is given for Docket 50220 microfiche items (1-232), which have been received by the USAEC Technical Information Center (TIC) through March 1974. This FIND covers three stages of Nine Mile Point Nuclear Station Unit 1: construction-permit, provisional-operating-license, and full-term-operating-license. For each stage, the docket report material is presented according to document grouping: Niagara Mohawk Power Corporation application/petition information (general, technical, environmental) and the AEC review (by Advisory Committee on Reactor Safeguards, Directorate of Licensing, Directorate of Regulatory Operations, Regulatory Adjudication). Issuances pertinent to the full-term-operating-license stage are indexed in greater depth than are the issuances of the two earlier stages. Subject citations identify the TIC item numbers and the microfiche sheet-frame numbers. Entries indicate, when applicable, superseded and supplemental items. (auth)

12051 (FIND-50443) FIND: SEABROOK STATION, UNITS 1 AND 2. Items 1-36. Asher, J. M. (ed.). (USAEC Technical Information Center, Oak Ridge, Tenn.). May 1974. 32p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major headings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (auth)

12052 (FIND-50448) FIND: DOUGLAS POINT NUCLEAR GENERATING STATION, UNITS 1 AND 2. Items 1-40. Williams, W. H. (ed.). (USAEC Technical Information Center, Oak Ridge, Tenn.). Jun 1974. 30p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major headings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (DG)

12053 (FIND-50452) FIND: GREENWOOD ENERGY CENTER, UNITS 2 AND 3. Items 1-33. Horn, F. H. (ed.). (USAEC Technical Information Center, Oak Ridge, Tenn.). May 1974. 34p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major headings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (DG)

12054 (PRDI-74-5) TITLE LISTING OF POWER REACTOR DOCKET INFORMATION. (USAEC Technical Information Center, Oak Ridge, Tenn.). May 1974. 62p.

Citations and subject indexing to the documentation associated with civilian nuclear power plants are presented. This material is that which is submitted to the Atomic Energy Commission in support of applications for construction and operating licenses. Citations are listed by Docket number in accession number sequence. The table of contents is arranged both by Docket number and by nuclear power plant name. (DCC)

12055 (PRDI-74-6) TITLE LISTING OF POWER REACTOR DOCKET INFORMATION. (USAEC Technical Information Center, Oak Ridge, Tenn.). Jun 1974. 76p. TIC $1.45.

Citations and subject indexing to the documentation associated with civilian nuclear power plants are presented. This material is that which is submitted to the Atomic Energy Commission in support of applications for construction and operating licenses. Citations are listed by Docket number in accession number sequence. The Table of Contents is arranged both by Docket number and by nuclear power plant name. (DG)

12056 DECOMMISSIONING OF NUCLEAR FACILITIES: A REVIEW OF STATUS. Bainbridge, G. R. (United Kingdom Atomic Energy Authority, Risley, Eng.); Bonhote, P. A.; Daly, G. H.; Detilleux, E.; Krause, H. At. Energy Rev.; 12: No. 1, 146-160(1974).

At the end of their useful lives it will be necessary to decommission nuclear facilities to provide radiological protection of the public and to release the site for further use. Stages of decommissioning have been defined, experience and techniques available have been discussed and specific operations have been reviewed. Development and assessment efforts required have been identified. The responsibilities of the owners/operators and the public authorities have been examined. It is concluded that international collaboration in decommissioning would be fruitful. (auth)

12057 CLASSIFICATION OF FUEL ELEMENTS OF NUCLEAR POWER PLANTS IN ACCORDANCE WITH TAX REGULATIONS. At. Inform.; No. 1, 18-19(1974). (In German).

The treatment of fuel elements of nuclear power plants reactors is described. The use of fuel elements in reactors of nuclear power plants differs from the use of conventional fuels in conventional power plants only in that the period of utilization normally covers several years. The period of utilization, however, is not a determining factor in the classification of economic goods under the tax regulations. The decisive feature in this case is the manner how such goods are utilized, and for what purpose. Hence fuel elements in nuclear power plant reactors are considered to be equal to conventional fuels and therefore fall under current assets. Each fuel element is to be treated as one individual economic good. (GE)

GENERAL

Civilian Defense

12058 (ORNL-tr-2707) TWP 1966: TECHNICAL DIRECTIVES FOR THE CONSTRUCTION OF PRIVATE AIR RAID SHELTERS AND THE 1971 CONCEPTION OF THE SWISS CIVIL DEFENSE. Cristy, G. A. (ed.). (Oak Ridge National Lab., Tenn. (USA)). 1971. Translated from Swiss translation. 76p. Dep. NTIS $5.45.

The 1971 conception of Swiss civil defense calls for "an aggregate expenditure of about 6.75 billions of francs" (approximately $2.2 billions) in the next two decades. The outlay of so large a sum, which would be used primarily to provide a shelter space for every inhabitant, is justified on the basis of (1) the presence of the germ of nuclear war even in limited conflicts between big powers, (2) the extension of the effects of nuclear weapons over such large surfaces that it is no longer possible to distinguish between "safe" and menaced regions, (3) the importance of being in a position to resist nuclear blackmail, and (4) the necessity of assuring the soldier that his family at home will be protected and cared for lest he lack one of the most important moral reasons to fight. Through their substantial civil defense the Swiss mean to convince the world of the seriousness of their neutrality. Part I of this translation provides technical details of design and construction of Swiss shelters under a variety of circumstances, and Part II presents the conception of Swiss civil defense. (auth)

Energy Utilization and Economics

Refer also to abstract 9497.

12059 (ORNL-EIS-74-52(Vol.2)(No.4)) NSF-RANN ENERGY ABSTRACTS. A Monthly Abstract Journal of Energy Research. Guthrie, M. P. (ed.). (Oak Ridge National Lab., Tenn. (USA)). Apr 1974. Contract W-7405-eng-26. 42p. Dep. NTIS $5.25.

Citations with abstracts are given for 94 publications covering energy sources, electric power, and energy production. Articles on economics, supply-demand, environmental effects, policy, management, and research are included. (SFL)

Information Handling

12060 (TID-4579-R8) SERIAL TITLES CITED IN NUCLEAR SCIENCE ABSTRACTS. (USAEC Technical Information Center, Oak Ridge, Tenn.). Mar 1974. 506p. Dep. NTIS $13.60.

The listing of titles represent the serials from which articles have been either abstracted or considered for abstracting in Nuclear Science Abstracts. Included are both those serials scanned and those selected for citation from other abstract journals, bibliographies, and reprints received from authors. A listing of abstract journals and other secondary sources scanned by TIC is included. (MCW)

12061 NEW DOSE RECORD KEEPING SERVICE. Greenslade, E. (National Radiological Protection Board, Sutton, United Kingdom). Radiol. Prot. Bull.; No. 7, 15-19(Apr 1974).

The national Radiation Dose Record Service initiated by the NRPB on 1st April 1973 is described in outline. Types of record provided are described and comments made on the 1st year of operation, during which 2600 workers were registered from 245 establishments. Difficulties have arisen in obtaining previous case histories of workers at the time of registration. Attention is drawn to the deficiencies of using the 5 rems/yr convention to provide a substitute history. (UK)

Law

Refer also to abstracts 9571, 9805, 10498, and 10499.

12062 (FDA-74-8023) FEDERAL/STATE RADIATION CONTROL LEGISLATION, 1973. Miller, L. A. (Food and Drug Administration, Rockville, Md. (USA)). Mar 1974. 40p.

A review is presented of Federal and State radiation control legislation for the calendar year 1973. A brief description of each bill introduced in 1973 and the status of each bill is included. Existing laws or statutes governing radiation control are also included. (CH)

12063 INTRODUCTORY LAW TO THE PENAL CODE. At. Inform.; No. 1, 18(1974). (In German).

On December 12, 1973 the German Bundestag passed the introductory law to the penal code at the third reading. This law is intended to free the secondary criminal law from provisions relating to crime and offense. Thus most of the penalty clauses of the atomic energy law (paragraphs 40-52) have been included in the penal code and are now ranging among criminal offenses constituting a public danger (paragraphs 306 ff.). Only the penalty clauses relating to the licensing of nuclear installations have remained within the nuclear energy law. (GE)

12064 RECENT ADDITIONS TO THE SPANISH NUCLEAR LAW. Tocino, M. I. Energ. Nucl. (Madrid); 17: No. 85, 363-370(1973). (In Spanish).

The additions to the Spanish Nuclear Law made since August 1972 are summarized. The legal and administrative dictates of the law are discussed. Jurisprudential resolutions are summarized. A thesis on "Nuclear Danger and Damage of Nuclear Centers" is summarized. A course developed by the Law faculty of the University of Madrid is described. (JSR)

12065 RADIATION PROTECTION. Kimminich, O. (Regensburg Univ., Ger.). pp 251-269 of Das Recht des Umweltschutzes: Land, Wasser, Luft, Muell, Laerm, Strahlen, Gifte, Atgase. Munich; Goldmann (1972).

The object, scope, and functions of the radiation protection legislation are determined and some scientific terms in this legal field are explained. The German (F. R.) Atomic Law and its additional regulations, and the Radiation Protection Ordinance are analyzed, as well as a group of regulations in other fields of environmental protection that are related to radiation protection. (GE)

Management

Refer also to abstract 9796.

12066 (INDC(SEC)-38-U) WRENDA 74: WORLD REQUEST LIST FOR NUCLEAR DATA MEASUREMENTS. Fission Reactor Programmes. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Apr 1974. 129p. Dep. NTIS (US Sales Only) $9.50.

This issue of WRENDA contains 1190 requests for nuclear data measurements for 632 data types needed in support of the fission reactor development programs of member states of the IAEA and one international organization. The request list is meant to serve as a guide to measurers and scientific and technical administrators. The list is ordered by increasing target Z and A number, then by projectile type (by increasing mass), and finally by reaction type. The various entries comprising the list are explained. (RWR)

12067 (LBL-3025) INDIVIDUAL FINANCIAL DECISION MAKING IN BASIC SCIENCE: A NORMATIVE AND DESCRIPTIVE STUDY. Zimmerman, J. L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1974. Contract W-7405-eng-48. 189p. Dep. NTIS $12.50.

Thesis.

12068 (TID-26470) ISSUANCES OF THE BOARD OF CONTRACT APPEALS, JULY 1972-DECEMBER 1973. (USAEC Technical Information Center, Oak Ridge, Tenn.). May 1974. 102p. Dep. NTIS $5.45.

Eight proceedings of the AEC's Board of Contract Appeals and Contract Adjustment Board from July 1972 to December 1973 are summarized. Indexes are included. (SFL)

12069 MAN-POWER IN THE GERMAN NUCLEAR RESEARCH AND NUCLEAR TECHNOLOGY. Results of a Recent Study. Rembser, J.; Steiniger, H. (Bundesministerium fuer Forschung und Technologie, Bonn). Atomwirt., Atomtech.; 19: No. 3, 114-119(Mar 1974). (In German).

The most important results of the investigation are summarized as to the number of personnel in the German nuclear industry and nuclear research, breakdown of the personnel according to employment and education and the personnel structure. (GE)

Mathematics and Computers

Refer also to abstract 9662.

12070 (AAEC/E-265) AAEC IMPLEMENTATION OF AND MODIFICATIONS TO RELEASE 21.6 OF THE IBM360 OPERATING SYSTEM. Hayes, I. J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Feb 1974. 64p. Dep. NTIS (US Sales Only) $6.25.

12071 (AECL-4702) FREAK: A CDC 6600 PROGRAM FOR MAKING FREQUENCY DISTRIBUTION TABLES. Evans, L. E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1974. 48p. Dep. NTIS (US Sales Only) $5.50. AECL $1.50.

12072 (ANL-8040(Supp. 1)) USAEC COMPUTER PROGRAM SUMMARIES: NUMBERS 55 THROUGH 123. (Argonne National Lab., Ill. (USA)). Apr 1974. Contract W-31-109-eng-38. 68p. Dep. NTIS $5.45.

In 1972 the scope of activities of the Argonne Code Center was officially expanded to include computer programs developed in all of the U. S. Atomic Energy Commission program areas. The Computer Program Summary report contains summaries of computer programs at the specification stage, under development, being checked out, in use, or available at Commission offices, laboratories, and contractor installations. The purpose of the report is to keep the USAEC, AEC-laboratory, and contractor personnel informed as to the existence, status, and availability of computer programs within the agency. The following information is provided for each program: author/contact, category, program identification and Key-Word-In-Context title, contractor, funding division, status, computer, programing language(s), program size, summary, references, availability, and distribution. Appendixes to this report contain the programs by subject category and a KWIC index. (RWR)

12073 (BDX-613-1079) APPLICATION OF STATISTICAL METHODS TO MANUFACTURING OPERATIONS. Latimer, C.; Carder, J. H. (Bendix Corp., Kansas City, Mo. (USA)). Mar 1974. Contract AT(29-1)-613. 38p. Dep. NTIS $5.25.

12074 (BNL-50416) USERS' MANUAL FOR THE MODEL AND LINDA DESIGN AUTOMATION PROGRAMS. Peskin, A. (Brookhaven National Lab., Upton, N. Y. (USA)). Feb 1974. Contract AT(30-1)-16. 35p. Dep. NTIS $5.45.

12075 (CEA-R-4561) STUDY OF MULTIPLE TIME SERIES BY DATA ANALYSIS. Braun, J. M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). May 1974. 117p. (In French). Dep. NTIS (US Sales Only) $9.00

Thesis.

12076 (COO-2280-5) CONVERGENCE ANALYSIS OF SOME FACTORIZATION ITERATIVE METHODS FOR M-MATRICES. Beauwens, R. (Northwestern Univ., Evanston, Ill. (USA)). Oct 1973. Contract AT(11-1)-2280. 37p. Dep. NTIS $5.00.

12077 (COO-2280-6) TRANSCENDENTAL FUNCTIONS GENERALIZING THE EXPONENTIAL INTEGRALS. Abu-Shumays, I. K. (Northwestern Univ., Evanston, Ill. (USA)). Nov 1973. Contract AT(11-1)-2280. 16p. Dep. NTIS $4.00.

12078 (COO-2280-7) POINT AND BLOCK FACTORIZATION ITERATIVE METHODS FOR ARBITRARY MATRICES AND THE CHARACTERIZATION OF M-MATRICES. Beauwens, R. (Northwestern Univ., Evanston, Ill. (USA)). Jan 1974. Contract AT (11-1)-2280. 50p. Dep. NTIS $5.50.

12079 (EUR-5113) CBNM SATELLITE COMPUTER SYSTEM. Part 1. The Multiparameter System User Handbook. Colling, F. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Apr 1974. 66p. Dep. NTIS (US Sales Only) $6.50. EUR B.Fr. 85.-.

12080 (EUR-5116) SLC-II SYSTEM LANGUAGE TRANSLATOR PACKAGE CONCEPTS AND FACILITIES. Perschke, S.; Fassone, G.; Geoffrion, C.; Kolar, W.; Fangmeyer, H. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Apr 1974. 103p. Dep. NTIS (US Sales Only) $8.25. EUR B.Fr. 150.-.

12081 (IPP-2-220) IPP-Netz, THE NETWORK PLANNING COMPUTER PROGRAM. Mueller, E.; Schmid, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1974. 93p. (In German). Dep. NTIS (US Sales Only) $7.75.

12082 (IS-M-16) PROJECTION ALGORITHM FOR SOLVING NONLINEAR SYSTEMS OF EQUATIONS. Georg, D. D.; Keller, R. F. (Ames Lab., Iowa (USA)). 1974. 26p. (CONF-740511-4). Dep. NTIS $4.50.

From mathematical software II conference; Lafayette, Indiana, USA (29 May 1974).

12083 (KFK-EXT-8-73-3) GRAPHIC: AN ICES SUBSYSTEM FOR GENERATING AND EDITING GRAPHICAL INFORMATION. Schuster, R.; Enderle, G. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Reaktorentwicklung). Dec 1973. 28p. INIS.

12084 (LBL-2480) NUMERICAL STUDY OF VISCOUS FLOWS PAST A CIRCULAR CYLINDER: APPLICATION OF CHORIN'S METHOD. Davari, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Dec 1973. Contract W-7405-eng-48. 59p. Dep. NTIS $5.45.

12085 (SLA-74-219) EXACT SOLUTION TO THE ONE-DIMENSIONAL STATIONARY ENERGY EQUATION FOR A SELF-HEATING SLAB. Shouman, A. R.; Donaldson, A. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1974. Contract AT (29-1)-789. 55p. Dep. NTIS $5.75.

12086 (SLL-74-234) CONSTRAINED LEAST SQUARES POLYNOMIAL FITS. Huddleston, R. E. (Sandia Labs., Livermore, Calif. (USA)). May 1974. Contract AT(29-1)-789. 21p. Dep. NTIS $4.25.

12087 (UCID-4671) GAME TREES, M AND N MINIMAXING, AND THE M AND N ALPHA BETA PROCEDURE. Artificial Intelligence Group Report No. 3. Slagle, J. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Nov 1963. 49p. Dep. NTIS $5.50.

12088 (UCLA-34-P-214-1) SURVEY OF PROTECTION STRUCTURES. Popek, G. J. (California Univ., Los Angeles (USA)). 1973. Contract AT(04-3)-34. 36p. Dep. NTIS $5.00.

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